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WHY BONELLI'S EAGLES HUNT IN PAIR : AN ASSESSMENT OF INDIVIDUAL AND PAIRED HUNTING SUCCESSES[1]

MILIND G. WATVE, NIRANJAN R. SANT AND VIJAY JOSHI[2]
(With a text-figure)

Key words: foraging behaviour, co-operative hunting, Bonelli's eagle

The hunting strategies and hunting successes of a breeding pair of Bonelli's Eagles were studied over five breeding seasons. Active hunting singly was found to be the most efficient method of hunting followed by active hunting in pair. The sit and wait methods were less efficient. In spite of active hunting in pair being significantly less efficient than hunting singly, the eagles spent much time soaring and hunting together. The possible explanations for this behaviour are discussed in this paper.

INTRODUCTION

The Bonelli's Eagle (*Hieraaetus fasciatus*) is a, slender built, medium sized resident eagle inhabiting lightly wooded hill ranges. It hunts either by a quick dash from cover (referred in this paper as the "sit and wait" method) or scans the hillsides while soaring and makes a stoop (the "active search" method). The breeding pair remains together even outside the breeding season and both the partners are often seen soaring and hunting together (Brown and Amadon 1968).

The hunting strategies of a breeding pair of Bonelli's eagles were observed over five breeding seasons to see whether hunting together is more beneficial than hunting singly. There could be following potential advantages of hunting in pair: (1) increase in search efficiency; (2) increase in killing efficiency; (3) the pair can kill larger prey than individuals; (4) protecting the kill from rivals; (5) reduction in handling time; (6) greater net energy gain.

It is also possible that one of the eagles is a cheater and takes advantage of the hunting skills of the other (Packer and Ruttan 1988). All of the above possibilities are discussed in the light of field data.

MATERIALS AND METHODS

A pair of Bonelli's eagles (*Hieraaetus fasciatus*) is resident in a hill range along the north-west boundaries of Pune city. Their nest was located on a *Dalbergia* sp. tree at about 15 metres height. The foraging behaviour of the pair was observed over five breeding seasons beginning from 1985-86. The nesting period was chosen for observations because the activities were centred around the nest, making observations easier and also there was much variation in the total food requirement during the nesting period. Out of the five seasons more than 70% of our observations came from the 1986-87 and 1988-89 seasons. Observations were restricted

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to week-ends and holidays. By placing three observers at a time along the crest line of the hill stretch, it was possible to keep the eagles in sight for 50 to 90% of the times during a day.

The following data were recorded:

1. The breeding success of the pair in 5 consecutive seasons: The success or failure to rear the nestlings to the fledgling stage was recorded for each year.

2. Time spent in active hunting and food gathered: The time spent in soaring, hunting attempts and prey handling was included in the active hunting time. The total time spent in active hunting per day and the number of kills brought to the nest were noted. When the eagles soared out of sight for a short time and returned, they were assumed to be hunting actively. However, when they were out of sight for more than 25% of the day, the day's observations were not included in this data.

3. Hunting efficiencies: When the eagles were in sight, the time spent in soaring alone or in pair, as well as the time spent on perch were recorded. The number of hunting attempts and the outcome was noted. Hunting efficiencies, search efficiencies and killing efficiencies were calculated from these data (Table 2).

Results and Discussion

The breeding success of the pair over 5 years was 0.8 fledglings per year (Table 1). This is similar to the success of the European race of Bonelli's eagles (0.8/pair/annum) and larger than the African race (0.5/pair/annum) (Brown and Amadon 1968).

Table 1

Year	No. of eggs laid	No. of nestlings survived
1985-86	?	1
1986-87	2	2
1987-88	2	0
1888-89 (first attempt)	2	0
1988-89 (second attempt)	1?	1
1989-90	2	0

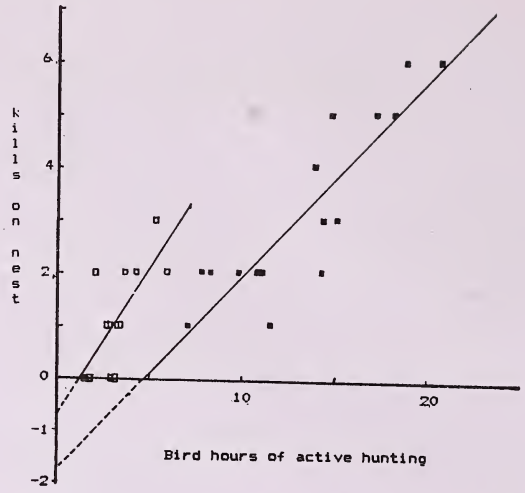

Fig. 1. Number of kills brought to the nest as a function of the time spent in active hunting.
[a] □ days when only the male hunted
r = 0.712 0 slope = Ya - Yp = 0.5437
Y intercept = -0.63054 estimated Kc = 2.196
[b] ■ days when both parents hunted
slope = 0.36032 Y intercept = - 1.6796
estimated Kc = 4.0286 (see equation 1.)

Throughout the five breeding seasons, the male hunted alone during incubation period and fed the female on or near the nest. This practice continued for two weeks after hatching. Between the 12th to 14th day the female joined the male in hunting for part of the day and her contribution increased rapidly during the following week. In the third and fourth week the pair did most of the active hunting together. In the 1986-87 season, when two nestlings successfully fledged, during the 6th to 8th week the eagles spent much time hunting separately in different locations particularly in the afternoon. In other seasons they tended to soar together for most of the time.

The efficiency of active search method was observed to be much higher than the sit and wait method (Table 2). This is consistent with the observation that, when the food requirement of the family was low, the sit and wait method was preferred, but as the food requirement of the family increased, more and more time was spent in active

TABLE 2

Hunting method		Single	Paired
Sit and wait	Hours observed	121	21.05
	no. of attempts per hour (search efficiency)	0.876	1.473
	success/attempt (killing efficiency)	0.198	0.355
	success/hour (hunting efficiency)	0.174	0.523 (0.261/bird hour)
Active search	Soaring hours observed	53.19	49.10
	no. of attempts per hour (search efficiency)	3.1	2.65
	success/attempt (killing efficiency)	0.33	0.43
	success/hour (hunting efficiency)	1.02	1.14 ** (0.507/bird hour)
No. of observed cases of failure to protect the kill		3 out of 54	0 out of 56
Mean handling time per kill (min.)		9.35	10.02

We test the null hypothesis that the efficiency of paired hunting = twice the efficiency of single hunting, by the likelihood ratio test.
** Null hypothesis rejected, efficiency of paired hunting less than twice that of single hunting.

hunting (Fig. 1). If we assume a fixed limit 'T' to the maximum number of hours available for hunting in a day, this time could have been divided into sit and wait and active hunting. We can therefore write the mean number of kills in a day (K) as,

$K = ta*Ya + (T-ta)*Yp$ where, ta = time spent in active hunting
Ya = efficiency of active hunting
Yp = efficiency of sit and wait

An estimate of K was difficult to obtain in the field since the eagles could be consuming a few kills when out of sight. An accurate record of the number of kills brought to the nest was however maintained and therefore we can write,

$Kn + Kc = ta*Ya + (T-ta) * Yp$
where, Kn = no. of kills brought to the nest
Kc = mean no. of kills consumed away from the nest or,
$Kn = ta (Ya-Yp) + TYp - Kc$ ——— (eqn. 1).

Since Ya > Yp (Table 2), a straight line with positive slope is expected when we plot the number of kills brought to the nest against the time spent in active hunting (Fig. 1). An estimate of Kc can then be obtained from the intercept.

In the active search method, as opposed to sit and wait method, by pairing the hunting success did not double (Table 2). The search efficiency of the pair in fact seemed to be less than that of individuals. This might be because when two birds were flying, the probability of alerting the prey was more (Anderson and Norberg 1981). This probably did not apply for sit and wait method where the search efficiency of the pair was observed to be more. The killing efficiency of the pair was better for both the methods but in case of active hunting this did not compensate for the twofold work input and decrease in search efficiency. Thus the eagles did not seem to do better by soaring together. In spite of this, the eagles seemed to prefer soaring together for 35 to 90% of the times in a day's hunt during the 3rd to 7th week of brooding.

The prey species could not be identified every time a kill was observed. From examination of remains of kills and pellets, no appreciable difference could be noted during incubation, when

the male hunted alone and during 3rd to 7th week, when most of the hunting was done in pair. Throughout the study period, the majority of prey ranged in size between quails and pigeons. A hornbill kill was found during incubation phase when the male hunted alone. A black naped hare was seen killed by the male alone. Thus there was no convincing evidence that the eagles killed larger prey when hunting together.

On three occasions the eagles lost their kill to either the tawny or the steppe eagles. On all these occasions the eagles were alone. A similar incident has been reported by Dharmakumarsinhji and Lavkumar (1972). On the other hand the pair was seen exchanging a kill in air in presence of three steppe eagles soaring immediately above. Thus apparently the pair was able to protect the kill better when together. The observed data do not show a statistically significant difference in the frequencies of being robbed when hunting singly or together. Assuming robbery to follow Poison distribution we can see that the chances of observing zero robbery are 0.2171, which is fairly high. But even if we assume the pair to be protecting better, the frequency of being robbed was not high enough to justify hunting in pair.

From energy considerations, hunting in pair could be beneficial if the net energy gain per unit time of the pair was more than double that of individuals. The net energy gain per unit time is defined as the energy gain per unit time from successful kills - the energy loss per unit time from unsuccessful attempts. Therefore,

$$Ys\,(Es^*Ps^*Ks - \{1-Ks^*Ps\}\,E's) < \frac{Yd\,(Ed^*Pd^*Kd - (1-Kd^*Pd)\,E'd)}{2}$$

where, Y = search efficiency (no. of attempts per hour)
E = mean energy gain per successful kill
K = killing efficiency (success/attempt)
P = probability of protecting the kill successfully from rivals
E'= energy loss in unsuccessful attempt

the suffix 's' denotes hunting singly and 'd' denotes paired hunting.

With the empirical values (for Ys, Ks, Yd, Kd, Ps, Pd, and with the assumption that Es = Ed and E's = E'd, it can be seen that,

$$3.1^*\,(0.92^*0.33^*E - 0.67^*0.92^*E') < 2.65^*\,(1^*0.43^*E - 0.57^*1^*E')/2.$$

This condition will be satisfied only if E' > 0.321 E. This is highly unlikely because with the energy loss in unsuccessful attempts being so high and only one attempt in three (Table 2) being successful, the eagles would hardly get enough for themselves and feeding the nestling would be impossible. Secondly, since they make use of thermal currents for soaring and gravitational force for diving, the energy input is not expected to be very high. This can be seen from the following computations. From Fig. 1a and eq.1 the mean number of kills consumed by the male per day during incubation period can be calculated to be 2.196. The incubating female on an average consumed one kill per day. If the basic metabolic requirement of the male is assumed to be similar, active hunting must have increased the requirement by 1 to 1.5 kills. The male made 3 to 5 kills per day during this period, which would mean about 9 to 15 attempts given the killing efficiency as 0.33. If 9 to 15 attempts increase the food consumption by 1 to 1.5 kills, the E'should not exceed 0.167 times E.

Active hunting in pair, therefore, cannot be explained on time and energy considerations. If the hunting efficiency of an individual is high, no advantage is expected by pairing (Packer and Ruttan 1988). Yet Bonelli's eagles soar together very frequently. If availability of food is not the limiting factor in regulating brood size or breeding success in case of eagles (Meyburg 1974), hunting strategies need not be optimized with respect to time and energy by natural selection. In such a case other factors like strengthening the pair bond or cheating might be more important in determining behaviour.

Throughout the nesting period, the male did the majority of the hunting and the female may be considered to be partially parasitic on the male. During incubation period, when the female was almost totally dependent on the male for food, soaring together was hardly ever observed. In paired hunting the initiative was most often taken by the male and the female followed. However,

many times the actual killing was done by the female. On three occasions, after locating the prey, the male stooped first followed by the female; the male missed the target but the female captured it successfully. This could be the reason why the killing efficiency of the pair was more than individuals. When only one nestling was reared, the maximum number of kills made in a day was 7 or 8. With the empirical hunting efficiency of individual hunting as 1.02/hour (Table 2) and assuming 9 to 10 hunting hours a day, the male alone could have gathered enough for the entire family. In spite of this the female joined the male in hunting. Thus neither the female seemed to be dependent on the male throughout the nesting period, nor soaring together was necessary when there was maximum dependence.

These data thus suggest that Bonelli's eagles do not hunt in pair in order to increase the efficiency of hunting. Although the efficiency of paired hunting is significantly low, it probably plays some role in the social behaviour of the eagles as very often they are seen soaring together. Soaring together may be important for strengthening the pair bond, advertisement of the territory or any other factors which could not be quantified during this study.

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THE BATS OF WESTERN INDIA REVISITED[1]
Part 3

P.J.J. Bates[2], D.L. Harrison[2] and M. Muni[3]

(With two plates and eight text-figures)

(Continued from Vol. 91(2): 240)

Family Rhinolophidae

Rhinolophus rouxii Temminck, 1835 - Rufous Horseshoe bat

Rhinolophus rouxii Temminck, 1835: Monographies de Mammalogie, 2: 30b. Pondicherry and Calcutta, India.

External characters: A medium-sized *Rhinolophus*, except for specimens from the Himalayas which average smaller; wings with a gradual decrease in size of metacarpals from the longer fifth to shorter third, in *R. ferrumequinum* the third is distinctly shorter than the fourth; in *rouxii*, the second phalanx of the third finger is usually equal to or less than 1.5 times the length of the first phalanx, in *R. affinis*, it is considerably longer and exceeds 1.5 times. Lancet of horseshoe variable in height, sometimes triangular in shape with straight sides, sometimes with well developed tip and concave margins below; superior connecting process of the sella rounded off above, comparable in morphology to that of *ferrumequinum* and *affinis*. Ears relatively small, especially in comparison to *ferrumequinum*. Pelage soft and silky, not woolly as in the larger *luctus*; considerable variation in pelage colour ranging from orange, to russet brown to buffy brown to grey; an apparent seasonal bias in colour such that the orange and rufous tints predominate from October to April and the paler phases are most common in specimens collected from May to September; no sexual bias.

Cranial and dental characters: Condylo-canine length of *R. r. rouxii* is comparable in size to that of *R. affinis*; palate with a relatively longer antero-posterior diameter, usually in excess of 1/4 of upper toothrow; mesopterygoid space broadly rounded off anteriorly, not narrowed as in *R. ferrumequinum.*

Dentition less robust than that of *R. ferrumequinum*; canine not in contact with the second upper premolar (pm^4); first upper premolar (pm^2) is well developed and usually situated in the toothrow; second lower premolar (pm^3) is also usually situated in the toothrow, although it may be extruded in a minority of specimens; the first (pm_2) and third (pm_4) premolars are not usually in contact.

Dental formula: i 1/2 c 1/1 pm 2/3 m 3/3 = 32.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	55.6	42 - 63	5.4	73
T:	27.1	23 - 33	2.2	76
HF:	10.6	8.0 - 12.8	1.2	73
TIBIA:	21.8	18.5 - 24.3	1.3	56
FA:	47.9	44 - 52	1.8	87
3MET:	36.8	33.0 - 39.4	1.3	80
4MET:	37.6	34.2 - 39.9	1.2	80
5MET:	38.0	35.5 - 40.3	1.2	80
3MET/1PH	14.2	10.7 - 16.1	2.0	67
3MET/2PH	21.1	17.9 - 24.2	1.4	62
WSP:	301.6	287 - 320	14.2	5
E:	19.6	15.5 - 22.0	1.2	71
GTL:	21.9	20.2 - 23.5	0.9	70
CCL:	18.9	17.4 - 21.0	0.9	82
ZB:	10.9	10.1 - 11.7	0.4	86
BB:	9.0	8.2 - 9.5	0.3	88
PC:	2.4	2.1 - 2.8	0.1	90
C-M^3:	8.4	7.6 - 9.2	0.4	98
C-M_3:	9.1	8.1 - 10.0	0.5	99
M:	15.0	13.4 - 16.4	0.7	99
M^2-M^2:	7.6	7.0 - 8.2	0.3	94

[1]Accepted September 1992.

[2]Harrison Zoological Museum, Bowerwood House, St. Botolph's\ Road, Sevenoaks, Kent, TN 13 3AQ, England.

[3]Bombay Natural History Society, Hornbill House, Dr. Salim Ali Chowk, Bombay 400 023, India.

Fig. 11. *Rhinolophus rouxii* ranges from India and Sri Lanka to southern China and Vietnam.

Records from INDIA include Solan [1], (Das, 1986) in **Himachal Pradesh**; Asgani [nl]; Savantvadi [2], (BMNH coll.); Bassein [3]; Borivli [4]; Vihar Lake [5]; Kanheri Caves [6]; Karnala [7]; Lohogad Fort [8]; Mahableshwar [9]; Bhaja Caves [10]; Khandala [11], (Brosset, 1962a); Poona [12], (Modak & Kamat, 1968) in **Maharashtra**; Poinguinim [13], (Agrawal, 1973); Canacona [14], (Sinha, 1973) in **Goa**; Yellapur [15], (BMNH coll.); Devikop [16], (Wroughton, 1912b); Potoli [17]; Dandeli [18]; Barchi [19]; Hulekal [nl]; Gersoppa [20], (Wroughton,1913); Sirsi [21], (Brosset, 1962a); Seringapatnam [22], (Ryley, 1913a); Bangalore [23], (Gopalakrishna & Rao, 1977); Talewadi [24], (this paper) in **Karnataka**; Tellicherry [25], (Jerdon, 1874); Silent Valley [26], (Das, 1986) in **Kerala**; Pondicherry [27], (type loc. of *rouxii*); Coonoor [28], (Blanford, 1888-91); Shevaroy Hills [29]; Benhoke [30]; Palni Hills [31], (Sinha, 1973) in **Tamil Nadu**; Cuddapah [32]; Balapalli Range [33], (Sinha, 1973) in **Andhra Pradesh**; Udaygiri [34]; Jharsuguda [35]; Kotagarh [36], (Das & Agrawal, 1973) in **Orissa**; Bastar district [37], (Das, 1986) in **Madhya Pradesh**; Mussoorie [38], (Blanford, 1888-91); Dhakuri [39], (Wroughton, 1914) in **Uttar Pradesh**; Calcutta [40], (type loc. of *rouxii*); Pashok [41]; Darjeeling [42], (BMNH coll.); Nimbong [43], (Sinha, 1973); Ajodhya Hills [44], (Das, 1986) in **West Bengal**; Tashiding [45], (Bhat, 1972) in **Sikkim** and Siki [46], (Lal, 1982) in **Arunachal Pradesh.** Extralimital localities based on BMNH and HZM collections for NEPAL; type localities of *rubidus*, *rammanika* and *cinerascens*, Phillips (1980), Wroughton (1915b) and Neuweiler *et al.* (1987) for SRI LANKA and Lal (1981) for upper BURMA.

Ecology: *Rhinolophus rouxii* is a forest species which is restricted to areas of relatively high rainfall. Its diurnal roosts tend to be humid and include caves, tunnels, hollow trees, wells, temples and less frequently old houses and barns. Males are excluded from the colonies during the period of parturition and lactation. The diet is comprised of grasshoppers, moths (Brosset 1962a); beetles and termites (Phillips 1924). Feeding begins after sunset; initially insects are mainly caught on the wing, the feeding flight is low, below tree top level, and individuals may often pass through near impenetrable bushes; this is followed by a period of inactivity of about 60-120 minutes; thereafter individuals forage throughout the night, but in "flycatcher style", alighting on a specific perch, such as dead twig and making very short flights to catch passing prey (Neuweiler *et al.* 1987).

Biology: There is a sharply defined breeding season. In Khandala, copulation takes place during the last week of December. The early development of the egg is slow and there is delayed implantation of the blastocyst. Gestation lasts 150-160 days and parturition occurs during the last week of May or early June in single sex maternal colonies, (Ramakrishna 1978). Lactation continues until the first week of August (Gopalakrishna and Rao 1977). Parturition occurs in May in Bangalore (Ramakrishna 1978).

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Talewadi (25 March)	Not known probably between 60-150 individuals	6	Large cave in forested area
Robbers' Cave Mahableshwar (28 March)	Not known	1	Natural cave with permanent water inside

Discussion: During the March 1992 survey, this species was observed at two sites. In both cases, the colony size could not be determined with accuracy. Brosset (1962a) located eleven colonies which ranged in numbers from a single individual to several hundred.

Status: This would appear to be a common species in India and requires no special conservation measures.

Rhinolophus lepidus Blyth, 1844 — Blyth's Horseshoe bat

Rhinolophus lepidus Blyth, 1844: Journal Asiat. Soc. Bengal, 13: 486. ? Calcutta.

External characters: This is a relatively small species of *Rhinolophus*. The forearm averages longer than that of *R. pusillus* and greatly exceeds that of *R. subbadius*. The pelage is typically grey-brown dorsally and slightly paler ventrally.

The horseshoe of the noseleaf measures between 6.8-7.3 mm in greatest breadth; the median emargination is narrow, lacking any posterior triangular groove. In contrast to *R. pusillus*, the sella is narrow basally and is not expanded centrally to any conspicuous extent; its upper part is parallel-margined or cuneate to a rounded tip. The connecting process is triangular with a straight anterior margin, blunt point and convex posterior margin. The lancet is triangular, tall and narrow with a blunt point (Hill and Yoshiyuki 1980).

Cranial and dental characters: The small skull has a well developed rostrum; rostral width, measured adjacent to the nasal swellings, ranges from 4.5-4.8 mm in *R. lepidus* to 4.1-4.5 mm in *R. pusillus*. In *R. hipposideros*, it is about 3.6 mm. The palate is emarginated anteriorly to a point equal to the paracone of m^1 and posteriorly to the metacone of m^2. The tympanic bullae are small, covering less than half of the large cochleae; the upper dentition usually exceeds 6.0 mm in length; in *R. pusillus* it is normally less than 6.0 mm. The small upper incisor is bicuspid; the first premolar (pm^2) is a functional tooth that lies within the toothrow.

Fig. 12. *Rhinolophus lepidus* ranges from Afghanistan, India, Burma and Thailand to southern China, Malaya and Sumatra.

Records from INDIA include Delhi [1], (Brosset, 1962a) in **Delhi**; Jodhpur [2]; Ranthambhore [3]; Sikar Burz [4]; Bikaner [5], (Prakash, 1961) in **Rajasthan**; Helwak [6], (Wroughton, 1916a); Kanheri [7]; Nasik [8]; Karnala [9]; Khandala [10]; Lonavla [11]; Lohogad [12]; Panchgani [13]; Mahableshwar [14]; Ratnagiri [15], (Brosset, 1962a); Khopoli [16], (Tiwari et al., 1971) in **Maharashtra**; Jog Falls [17], (BMNH coll.); Gersoppa [18], (Wroughton, 1913) in **Karnataka**; Silent Valley [19], (Das, 1986) in **Kerala**; Salem [20], (Das, 1986) in **Tamil Nadu**; Palkonda Hills [21]; Koduru [22], (BMNH coll.); Vishakhapatnam district [23], (Das, 1986) in **Andhra Pradesh**; Khandagiri [24]; Mohana [25], (Das & Agrawal, 1973) in **Orissa**; Sohagpur [26]; Narsingarh [27], (Wroughton, 1913); Mandu [28], (Brosset, 1962a); Jabalpur district [29], (Khajuria, 1979) in **Madhya Pradesh**; Mussoorie [30], (type loc. of *monticola*); Khati [31]; Almora [32]; Ranibag [33]; Philibhit [34], (Wroughton, 1914) in **Uttar Pradesh**; Singar [35]; Nimiaghat [36]; Luia [37], (Wroughton, 1915c); Gaya [38], (Siddiqi, 1961); Madhuban [39]; Munger [40]; Manharpur [nl], (Sinha, 1986) in **Bihar**; Midnapore [41], (Siddiqi, 1961); Salbani [42], (Sinha, 1980); Gurup [43], (Lal & Biswas, 1985) in **West Bengal**; Sibsagar [44], (Kurup, 1968) in **Assam**; Syndai [45]; Konshnong [46]; Shangpung [47], (Hinton & Lindsay, 1927) in **Meghalaya**. Extralimital localities based on Mitchell (1980) for NEPAL; BMNH coll., Wroughton (1915a) and Wroughton (1916a) for upper BURMA.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	44.9	39 - 54	4.1	22
T:	22.1	18 - 28	3.2	22
HF:	7.9	5.5 - 9.8	1.2	23
TIBIA:	16.5	14.9 - 17.4	0.6	19
FA:	40.0	38.0 - 41.8	1.0	24
3MET:	31.0	29.0 - 33.1	1.0	19
4MET:	31.7	30.0 - 33.6	0.9	19
5MET:	31.4	29.7 - 33.3	0.8	19
E:	16.5	15.0 - 18.2	0.9	22
GTL:	17.8	17.0 - 18.4	0.5	6
CCL:	15.0	14.5 - 15.5	0.3	16
ZB:	8.3	8.0 - 8.8	0.2	19
BB:	7.3	6.7 - 7.8	0.3	19
PC:	2.2	1.8 - 2.6	0.2	20
C-M^3:	6.3	6.0 - 6.8	0.2	20
C-M_3:	6.7	6.4 - 7.4	0.2	20
M:	11.4	10.7 - 12.1	0.4	20
M^2-M^2:	5.9	5.6 - 6.7	0.3	20

Ecology: *Rhinolophus lepidus* favours wooded or forested country (Brosset 1962a), although Prakash (1961) found it in small numbers at Bikaner in a desert biome. It is found at a variety of altitudes ranging from 246-2338 metres (800-7600 feet) (Wroughton 1914). Diurnal roosts include dungeons, caves, tunnels, subterranean silos (Brosset 1962a), old houses (Sinha 1986) and ruined temples, (Lal and Biswas 1985). It sometimes lives alone or in scattered groups or sometimes in very compact clusters where a dozen to several hundred individuals are closely pressed together. The two sexes are not segregated. There appears to be a small, well marked hunting territory, which is often close to the diurnal roost. It hunts alone with a slow, low and fanciful flight.

It explores the foliage of trees, coming and going through the branches, with frequent stops to pick an insect off a leaf (Brosset 1962a). It feeds on small insects such as mosquitoes, small moths and Coleoptera (Brosset 1962a); Dipteran flies and Hymenopteran insects (Sinha 1986).

Biology: In Maharashtra, females give birth to a single infant at the beginning of May (Brosset 1962a).

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Hindola Palace, Mandu (11 March)	Three colonies: each of 40-50 individuals	4	Dungeons near palace
Lohani Caves, Mandu (13 March)	50- 60 individuals	2	Man-made caves, with water supply inside

Discussion: During the March 1992 survey, this species was seen at two different localities at Mandu. The colony sizes appeared similar to those observed by Brosset (1962a) in this ancient city. Brosset also collected specimens at Mahableshwar. This species was not mist netted at this latter locality during the recent survey, but may have been present in small numbers.

Status: This species appears to have a relatively stable population. However, many of its diurnal roosts are potentially susceptible to disturbance by man, not least those in sites of archaeological interest. The fitness of populations in roosts such as Mandu and Tuglakabad Fort, New Delhi deserve careful monitoring.

Hipposideros fulvus Gray, 1838 — Fulvous Leaf-nosed bat

Hipposideros fulvus Gray, 1838: 492. Dharwar, India.

External characters: A relatively small species of *Hipposideros* with very large ears. Forearm length exceeds that of *H. ater* but is significantly shorter than that of *H. speoris.* Ears with tips broadly rounded off, posterior margins

Fig. 13. *Hipposideros fulvus* ranges from Afghanistan to India, Bangladesh and Sri Lanka.

Records from INDIA include Jaipur [1], (BMNH coll.); Jodhpur [2]; Jhalara-Patan [3]; Ajmer [4], (Sinha, 1980); Bundi [5]; Dungarpur [6]; Jhalawar [7], (Advani, 1982); Bharatpur [8], (Bhupathy, 1987) in **Rajasthan**; Bhuj [9], (Wroughton, 1912a); Junagadh [10]; Rajkot [11]; Keshod [12]; Talala [13]; Sasan [14]; Sadla [15], (Ryley, 1913b); Palanpur [16], (Ryley, 1914a); Bochasan [17], (Brosset, 1962a) in **Gujarat**; Bandra [18], (BMNH coll.); Shirgaum [19], (Wroughton,1916a); Elephanta [20], (Ali, 1953); Chikalda [21]; Aurangabad [22]; Nasik [23]; Bombay [24]; Vihar Lake [25]; Lonavla [26]; Mahableshwar [27]; Ratnagiri [28], (Brosset, 1962a); Nagpur [29], (Sabnis, 1973); Nanded [30]; Marathwada [nl], (Madhavan *et al.*, 1978) in **Maharashtra**; Gadag [31]; Dharwar [32], (Wroughton, 1912 b); Honawar [33]; Vijyanagar [34], (Wroughton, 1913); Coromandal [35], (Ryley, 1913a); [specimen from Haleri listed by Ryley (1913b) considered to be type of *pomona*, (Hill *et al.*, 1986)] in **Karnataka**; Sohagpur [36], (BMNH coll.); Hoshangabad [37], (Wroughton, 1913); Shepore [38], (Lindsay, 1927); Jabalpur District [39], (Khajuria, 1979) in **Madhya Pradesh**; Varanasi [40], (Khajuria, 1979) in **Uttar Pradesh**; Chaibassa [41], (BMNH coll.); districts of Darbhanga [42]; Gaya [43]; Giridih [44]; Hazaribag [45] and Munger [46], (Sinha, 1986) in **Bihar**. Extralimital localities based on Siddiqi (1961), Roberts (1977) and Wroughton (1916c) for PAKISTAN and Scully (1887) for NEPAL. There is no confirmation that this species has been found in SRI LANKA; it would appear that past records, (Ryley, 1914b; Wroughton, 1915b), are in fact referrable to *H. ater.*

Hill *et al.* (1986) suggest that specimens from Sikkim, north-east India and Burma (and therefore by inference Bangladesh) referred to *H. fulvus* may actually prove to be *H. pomona*; therefore the following records have not been included on the map: Pashok; Narbong, (Wroughton, 1916b) in West Bengal; Rongli, (Wroughton, 1916b) in Sikkim; Nazira; Sibsagar; Cachar, (Kurup, 1968) in Assam; Cherrapunji, (Kurup, 1968) in Meghalaya; Kamorta Island, (Saha, 1980) in Nicobar Islands.

without a concavity near the tip. Noseleaf without supplementary leaflets; anterior leaf with a greatest width of about 5.0 mm; internarial septum uninflated; intermediate leaf simple; posterior leaf subdivided into four cells by three vertical septa. Pelage variable in colour ranging from dull yellow to pale grey to golden-orange. Adult weight ranges from 8 to 9 grams (Gopalakrishna 1969).

Cranial characters: Skull intermediate in size between *H. speoris* and the smaller *H. ater*. Rostrum relatively narrower than that of *H. speoris*, with the nasal inflations less developed and without a shallow frontal depression; zygomata with well defined post-orbital projections; anterior border of mesopterygoid space usually V-shaped. Skull differs from that of *H. pomona* in having the posterior part of the vomer narrow and rather more slender, a narrower sphenoidal bridge and a narrower sphenoidal depression, (Hill *et al.* 1986). Anterior upper premolar (pm^2) minute, extruded from the toothrow, c^1 and second upper premolar (pm^4) in contact or nearly so. In contrast to *H. pomona*, anterior lower premolar (pm_2) much reduced, its length one quarter to one third the length of the second premolar (pm_4), its height one quarter to one half the height of that tooth. In *pomona* pm_2 is less reduced, its length one half or more the length of pm^4 and its height two thirds that of the second tooth (Hill *et al.* 1986).

Dental formula: i 1/2 c 1/1 pm 2/2 m 3/3 = 30.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range			s	n
HB:	46.7	40	-	52	3.1	33
T:	29.2	24	-	35	3.2	32
HF:	7.6	5	-	11	1.4	32
FA:	40.4	37.9	-	44.0	1.8	34
E:	21.8	19.0	-	24.0	1.0	32
GTL:	18.0	17.2	-	18.6	0.3	25
CCL:	15.6	15.0	-	16.4	0.3	34
ZB:	9.2	8.6	-	9.6	0.2	38
BB:	8.4	7.5	-	9.4	0.5	37
PC:	2.5	2.2	-	2.8	0.1	41
$C\text{-}M^3$:	6.3	6.0	-	6.9	0.2	45
$C\text{-}M_3$:	6.8	6.4	-	7.5	0.2	47
M:	11.5	10.9	-	12.2	0.3	42

Ecology: *Hipposideros fulvus* is found in a variety of natural biomes ranging from dry plains to forests at the highest levels of the Ghats (Brosset 1962a). Its diurnal roosts include porcupine earths (Ryley 1913b), cellars, old houses, dilapidated buildings (Madhavan *et al.* 1978), caves, tunnels (Brosset 1962a) and open wells (Roberts 1977). It favours cool damp places and relies on the proximity of water and shade. Colony size ranges from a few individuals to over 200; when roosting it remains isolated from its neighbour.

The hunting territory is close-by and hunting groups are comprised of four to five individuals. The flight is slow and fluttering and it hunts very close to the ground. The roost is often revisited during the night. It appears to favour cockroaches and beetles (Madhavan *et al.* 1978).

Biology: In Maharashtra, copulation, ovulation, fertilisation and pregnancy all occur in mid-November. The gestation period lasts 150-160 days and parturition takes place in a two week period during the last week of April and first week of May.

The single infant is carried by the mother continually for 20-22 days or until it weighs about 4.5 grams. Lactation occurs until 29 July; there is communal suckling within the colony.

Sexual maturity for both sexes is attained at 18-19 months.

Adult females are more common than males (Madhavan *et al.* 1978).

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Elephanta (8 March)	18 in three caves	1	Man-made caves

Discussion: Brosset (1962a) located this species at nine localities; colony size varied from 8 to 250 individuals. During the recent expedition it was only seen at Elephanta, where the colony

size was considerably reduced from that reported by Brosset (1962a).

Status: This species has wide geographical range but appears to have a relatively low population density. It is probable that tourist pressure at some of the more popular archaeological sites has led to a reduction in colony size.

Hipposideros speoris (Schneider, 1800) — Schneider's Leaf-nosed bat

Vespertilio speoris Schneider, 1800: pl. 59b. Tranquebar, India (Tate 1941: 377).

External characters: A medium-small species of *Hipposideros*, with the forearm significantly longer than that of *H. fulvus* but the ears markedly smaller and with pointed tips. Noseleaf with three supplementary leaflets; posterior leaf divided into four cells by three vertical septa, its upper edge slightly thickened and without processes; frontal sac present in males; in females represented by a tuft of hairs. Hind feet large in comparison to those of *H. fulvus*. Pelage colour variable; some individuals are grey, palest on the ventral surface and between the shoulders on the upper back, darker on the flanks and posteriorly; others are yellowish-brown or bright orange-brown. Body weight of males and non-pregnant females is 9-10 grams (Gopalakrishna and Bhatia 1982)

Cranial and dental characters: Skull short and robust with the sagittal crest well defined anteriorly and with low supraorbital ridges. Unlike *H. fulvus*, there is a shallow frontal depression. Nasal inflations well developed, separated by a shallow groove; mesopterygoid space is U-shaped anteriorly. Upper incisor simple and spatulate; upper canine with weak anterior and low posterior cusps; anterior upper premolar (pm^2) compressed and extruded from tooth row; second upper premolar (pm^4) with well defined anterior cusp; anterior lower premolar (pm_2) relatively larger than that of *H. fulvus*.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range			s	n
HB:	54.7	46	-	62	3.7	42
T:	25.2	20	-	29	2.3	42
HF:	8.2	7	-	11	0.7	42
FA:	50.8	46	-	54	1.6	50
E:	16.9	13	-	19	1.3	43
GTL:	19.4	18.3	-	20.5	0.5	44
CCL:	16.6	15.9	-	17.5	0.4	52
ZB:	10.9	10.2	-	11.5	0.4	53
BB:	8.6	8.1	-	9.0	0.3	53
PC:	2.9	2.5	-	3.2	0.2	63
$C\text{-}M^3$:	7.2	6.6	-	7.5	0.2	67
$C\text{-}M_3$:	7.7	7.2	-	8.5	0.3	67
M:	13.1	12.3	-	13.9	0.3	66

Ecology: *Hipposideros speoris* is found in a variety of biotopes ranging from dry, flat country to forested hills; it has been collected at altitudes ranging upto 1385 metres (4500 feet) in Sri Lanka (Phillips 1980). Its diurnal roosts include crevices in hills (Wroughton 1913); caves, caverns; disused buildings (Phillips 1980); tunnels and temples (Brosset 1962a). Colony size ranges from a few individuals to several hundred or even a thousand (Brosset 1962a, Usman 1988). According to Brosset (1962a), at Badami in Karnataka, it leaves the diurnal roost about 10 minutes after sunset and tends to feed close to the roost. It hunts in groups of 10-15 individuals, flying close to the ground, almost touching rocks and bushes, with a slow but very skilful flight and with continual changes of direction. It feeds on mosquitoes, flies (Brosset 1962a); beetles and other low flying insects, especially termites (Phillips 1980).

Biology: At Chandrapur in Maharashtra, copulation, followed by ovulation and fertilization, takes place in different individuals of the colony on different dates from the last week of December to the second week of March. Gestation lasts for 135-140 days and parturition in the colony takes place from the first week of May to the last week of July. The majority of deliveries occur between 17 May and 13 June.

Females in lactation were collected until 14 September. The single infant is carried by the mother until it weighs about 6 grams. Females attain sexual maturity at 7.5 to 8 months whilst males do

Fig. 14. *Hipposideros speoris* is confined to the Indian subcontinent.

Records from INDIA include Baroda [1]; Rajmahal [2], (Sinha, 1981) in **Gujarat**; Asgani [nl], (BMNH coll.); Elephanta [3]; Borivli [4]; Kanheri [5]; Poona [6]; Alibag [7]; Pakhal [8], (Shivkumara Swamy *et al.*, 1984); Chanda [8], (Blanford, 1888-91); Nanded district [9], (Gopalakrishna & Bhatia, 1982); Ellora [10], (this paper) in **Maharashtra**; Mysore [11]; Kolar [50], (BMNH coll.); Gadag [12], (Wroughton, 1912b); Gersoppa [13]; Honawar [14]; Vijayanagar [15], (Wroughton, 1913); Seringapatam [16]; Sivasamudram [17], (Ryley, 1913a); Wotekolli [18], (Ryley, 1913b); Hampi [19]; Pattadkal [20]; Badami [21], (Brosset, 1962a); Belgaum [22], (Sinha, 1976); Bangalore [23], (Ramakrishna *et al.*, 1981) in **Karnataka**; Trivandrum [24], (Sinha, 1976) in **Kerala**; Kurumbapatti [nl]; Tirthamalai [nl], (BMNH coll); Salem [25]; Madras [26], (Jerdon, 1874); Trichinopoly [27]; Travancore [28], (Blanford, 1888-91); Nagercoil [29], (Sinha, 1976); Keela Kuyil Kudi [30]; Kanavai Katha Bootham [nl]; Pannian Malai [51], (Usman, 1988); Madurai [31], (Marimuthu & Selvanayagam, 1981) in **Tamil Nadu**; Koduru [32]; Thummalah [33], (BMNH coll.); Nellore [34], (Jerdon, 1874); Cuddapah [35]; Palkonda Hills [36], (Sinha, 1976) in **Andhra Pradesh**; Mahendragiri [37], (BMNH coll.) in **Orissa**; Dehra Dun [38], (Jerdon, 1874) in **Uttar Pradesh.** Extralimital localities based on BMNH coll., Wroughton (1915b), Phillips (1980) and Ryley (1914b).

not attain maturity until at least 16-17 months (Gopalakrishna and Bhatia 1982). Ramakrishna *et al.* (1981) noted that the breeding season commences in mid-November in Bangalore; in Tamil Nadu, most females gave birth during September and October (Radhamani *et al.* 1990).

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Ellora (4 March)	40-50 individuals in cave 16	2	Artificial cave

Discussion: Brosset (1962a) located this bat at nine localities. It was extremely common in some sites, for example at Alibag where colony size was estimated at 1000 in a natural cave on a hill. During this recent study, it was only found at Ellora. It was not seen at Elephanta, although Brosset (1962a) had previously located a colony of some 350 specimens in an artificial cave.

Status: This is a widespread and plentiful species. Although only one colony was located on this recent survey, it is apparently a common species throughout much of its range.

Hipposideros lankadiva Kelaart, 1850 — Kelaart's Leaf-nosed bat

Hipposideros lankadiva Kelaart, 1850: 216. Kandy, Ceylon.

External characters: A large *Hipposideros* with a characteristic pelage colour ranging from pale cream, to fulvous brown, orange and even a bright red (Brosset 1962a); tends to be darker on the forehead, shoulders and on the rump; paler on the belly. Noseleaf with four supplementary leaflets bordering the horseshoe, the fourth much reduced, sometimes absent. The maximum weight of males is 76 grams and of non-pregnant females is 55 grams (Sapkal and Bhandarkar 1984).

Cranial and dental characters: Skull robust with the frontal region of the rostrum inflated and convex, in *H. armiger* it is flattened; unlike *H. diadema*, there is no posterior depression. Breadth of the frontals (8.1-8.5 mm) is significantly narrower than that of *H. armiger* (9.6 mm). In lateral profile, there is a sharp angle between the plane of the nasal orifice and the dorsal surface of the nasal inflations; in *H. armiger* this sharp angulation is not present. Sagittal crest less well developed than that of *H. armiger* and braincase shallower in dorsal-ventral diameter; mesopterygoid space V-shaped anteriorly, in *H. armiger* it is rounded; cochlea of each tympanic bulla less inflated than that of *H. armiger.* Upper incisor bicuspid; anterior upper premolar (pm^2) smooth crowned and minute, situated external to the cingulum of c^1; crown area of outer lower incisor greatly exceeds that of the inner.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	92.2	89 - 98	3.6	5
T:	46.0	39 - 58	7.5	6
HF:	15.3	12.7 - 20	2.6	6
FA:	89	84 - 99	5.2	1
WSP:	468	468 - 468	-	1
E:	23.6	19.5 - 30	37	6
GTL:	32.9	30.2 - 36.0	2.5	7
CCL:	29.4	27.1 - 31.0	1.5	9
ZB:	19.2	17.5 - 20.6	1.2	12
BB:	12.1	11.2 - 13.2	0.8	10
PC:	3.9	3.5 - 4.2	0.3	10
$C\text{-}M^3$:	13.8	12.5 - 14.5	0.7	14
$C\text{-}M_3$:	15.2	13.7 - 16.5	1.0	12
M:	24.4	22.0 - 26.2	1.6	13

Ecology: *Hipposideros lankadiva* is only known from a few colonies in the Indian subcontinent. Colony size ranges from 50 to several thousand individuals. Roosts include caves, old tunnels (Phillips 1980) and old temples (Sapkal and Bhandarkar 1984). It is easily disturbed, (Sapkal and Bhandarkar 1984) and a colony of the closely related *H. schistaceus* at Vijayanagar was completely deserted after gun-shots were fired within it (Wroughton 1913). Both sexes are usually found

Fig. 15. *Hipposideros lankadiva* is confined to the Indian subcontinent.

Records from INDIA include Bhimbharak [1], (Wason, 1978) in **Rajasthan**; Chandrapur [2], (Sapkal & Bhandarkar, 1984) in **Maharashtra**; Vijayanagar, (referred to *schistaceus* Wroughton, 1913); Kolar [3], (Ryley, 1913a); Gersoppa [4], (Brosset, 1962a) in **Karnataka**; Balharshah [nl], (Gopalakrishna, 1986); Mundra [5]; Hoshangabad [6], (Wroughton, 1913); Mandu [7], (Brosset, 1962a) in **Madhya Pradesh**; Siju Cave [8], (Kurup, 1968) in **Meghalaya**. Extralimital localities based on BMNH coll. and Phillips (1980) for SRI LANKA.

10. *Rhinolophus rouxii;* 11. *Rhinolophus lepidus;* 12. *Hipposideros fulvus;* 13. *Hipposideros speoris.*

14. *Hipposideros lankadiva;* 15. *Otomops wroughtoni;* 16. ***Pipistrellus ceylonicus;*** 17. ***Miniopteris schreibersii.***

in the same colony throughout the year.

When at rest, its wings are not folded round ıe body but extended as in *Taphozous* and *hinopoma* (Wroughton 1913).

It is frequently a high flyer and may be seen in ˙e early evening, 'hawking' high up in the air, in the company of bats such as *Pipistrellus*, (Wroughton 1913). Its heavy dentition permits it to eat large, hard insects, particularly Coleoptera; quanties of fat are stored at the base of the tail and reabsorbed during winter (Brosset 1962).

Biology: It breeds once a year. At Chandrapur, copulation takes place between 22 August and 5 September. The gestation period is about 260 days; it is prolonged due to a retarded development of the embryo after implantation. Deliveries take place between 10-31 May and females were found carrying their single young until 26 June, when the juveniles weighed 22 grams. Sexual maturity is not attained in the year of birth (Sapkal and Bhandarkar 1984).

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Mandu (14 March)	Not located	4	Collected in mist net, situated at head of valley, adjacent to Hotel Nataraj

Discussion: This species would appear to be restricted to a limited number of large colonies. Brosset (1962a) observed an enormous colony of 5000-7000 in the subterranean retreats of the Champa Baoli (palace) at Mandu. This has subsequently been superseded by an equally large colony of *Rousettus leschenaultii* and *Taphozous melanopogon*. However, that individuals were caught in a near-by mist net suggests that the colony has moved but is still present within the general area.

Status: *Hipposideros lankadiva* is an uncommon species endemic to the subcontinent. It is recorded from just eight localities within India. It is apparently easily disturbed by man. Its roosts deserve special protection.

Otomops wroughtoni (Thomas, 1913) — Wroughton's Free-tailed bat

Nyctinomus wroughtoni Thomas, 1913: 87. Barapede Cave, near Talewadi, Kanara, India.

External characters: Pelage a rich glossy dark chocolate brown above, especially on crown of head and rump; thin white border on each flank, extending from axilla to groin, and on antibrachial membranes; shoulders and nape of neck with characteristic, strongly contrasting pale greyish white mantle, upper back with admixture of paler hairs; ventral surface, dull brown but with a contrasting grey collar, variably extending onto chin and upper chest; dark hairs present on underside of wing to a line extending from elbow to mid-thigh. Ears very large, connected medially, inner margin convex, dotted with a number of small horny points; tip broadly rounded; no antitragus, but with well developed extra lobe on inner side of conch; tragus minute, triangular. Small, shallow gular sac present in both sexes.

Cranial and dental characters: Skull relatively long, smooth and well rounded; a marked concavity present on the upper braincase at the fronto-parietal suture; premaxillaries not always co-ossified; anterior palatal foramen small, flask-shaped, widest posteriorly; posterior edge of palate level with m^3; basisphenoid pits deep and sharply defined, with overhanging edges; septum well developed; tympanic bullae very large and elongated, their antero-internal border nearly, or in contact with, pterygoids. Single upper incisor simple, well developed, about half the height of the canine, shaft narrowing both above and below the cingulum; canine slender but well developed, cingulum distinct, but without secondary cusps; first upper premolar (pm_2) small, located in tooth row, sometimes in contact with second upper premolar (pm_4), which is well developed and with a large antero-internal cusp; upper molars normal. m^3 not greatly reduced; lower incisors very small, bifid, crowns in contact with each other and with canine; lower premolars normal in form and size,

Fig. 16. *Otomops wroughtoni* is only known from the type locality of Barapede Cave, Talewadi near Belgaum [1] in **Karnataka**, INDIA.

the first (pm_2) not as high as second (pm_4) but with the cross section nearly as great; lower molars with the three inner cusps approximately equal in height.

Dental formula: i 1/2 c 1/1 pm 2/2 m 3/3 = 30.

Measurements: Based on specimens of both sexes from India.

	mean	range	s	n
HB:	92.1	87 - 99	3.8	11
T:	45.2	43 - 48	2.3	11
HF:	11.8	10 - 14	1.2	11
FA:	64.5	58 - 67	2.7	11
WSP:	421.3	408 - 433	12.6	3
E:	32.5	31 - 34	0.8	11
GTL:	24.8	24.2 - 25.2	0.4	8
CBL:	22.7	22.1 - 23.2	0.4	8
ZB:	13.1	12.6 - 13.3	0.2	7
BB:	11.1	10.9 - 11.3	0.1	8
PC:	5.3	5.1 - 5.6	0.2	10
$C\text{-}M_2$:	9.0	8.8 - 9.2	0.1	11
$C\text{-}M_3$:	9.5	9.2 - 9.8	0.2	11
M:	16.4	15.9 - 16.9	0.3	11

Ecology: *Otomops wroughtoni* is apparently confined to one diurnal roost, a large natural cave, situated on a remote plateau rising above a forested valley at an altitude of about 800 metres (2600 feet). The entrance to the cave is concealed by trees and bushes. The cave is about 40 metres deep, 25 metres broad and 6-7 metres high; there are permanent patches of water and a high degree of humidity. Colony size is difficult to determine as *Otomops* lives in small groups of usually five to seven individuals in narrow cracks and deep hollows in the roof. During the day, they keep silent and motionless; they hang by their feet, head down and with only the extremity of their muzzles protruding; both sexes live together. According to Prater (1914), a single shot fired into one hollow secured some 30 specimens; later, Brosset (1962b) estimated the whole colony to number about 40 individuals. When disturbed they fly within the cave from one hollow to another. They coexist with *Megaderma spasma* and *Rhinolophus rouxii* (Brosset 1962b). Their flight is strong, fast and straight. According to Brosset (1962b), the dentition is relatively weak and unsuitable for crushing big or hard insects.

Biology: A female with a single young was found in December; other females each had a single foetus (Prater 1914). The twelve specimens collected in May 1961 and the one female in March 1992 were sexually dormant.

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Talewadi (25 March)	Uncertain, 40 +	3	Natural cave

Discussion: To date, this species is only known from one cave situated near the village of Talewadi. This site has only been visited on a limited number of occasions by zoologists who on each occasion reported the presence of *Otomops* within the cave.

Status: An endemic bat with an apparently very restricted range. It deserves all possible protection.

Pipistrellus ceylonicus (Kelaart, 1852) — Kelaart's Pipistrelle.

Scotophilus ceylonicus Kelaart, 1852: 22. Trincomalee, Ceylon.

External characters: A relatively large Pipistrelle, with a forearm that usually exceeds 35 mm; dorsal pelage variable in colour, ranging from grey-brown to chestnut, reddish or golden-brown; belly with dark hair bases and pale tips; adult specimens weigh between 7-8 grams and have a wing span of about 250 mm (Madhavan 1971); each ear with a well developed tragus, which measures 4.5-4.8 mm in height and 2.1-2.4 mm in greatest width, basal lobule well defined; baculum with long slender shaft curved upwards, tip bifid and strongly bifurcate, base also

Fig. 17. *Pipistrellus ceylonicus* ranges from Pakistan, India and Sri Lanka to Burma, China, Vietnam and northern Borneo.

Records from INDIA include Mount Abu [1], (Ryley, 1914a) in **Rajasthan**; Bulsar [45], (BMNH coll.); Bhuj [2]; Charwa [3], (Wroughton, 1912a); Junagadh [4]; Keshod [5]; Talala [6]; Sasan [7]; Rajkot [8], (Ryley, 1913b); Ahmedabad [9]; Anand [10]; Baroda [11], (Brosset, 1962b); Broach [12]; Rajpipla [13], (Sinha, 1981) in **Gujarat**; Bandra [46]; Thana [47], (BMNH coll.); Helwak [14], (Wroughton, 1916a); Chikalda [15]; Ajanta [16]; Nasik [17]; Junnar [18]; Bombay [19]; Poona [20]; Satara [21], (Brosset, 1962b); Panchgani [22], (Tiwari *et al.*, 1971); Belgaon [nl], (Khajuria, 1967); Aurangabad [23]; Nagpur [24], (Sabnis, 1973); Nanded [25], (Madhavan, 1971) in **Maharashtra**; Gadag [26], (Wroughton, 1912b); Sirsi [27]; Honawar [28]; Vijyanagar [29], (Wroughton, 1913); Bangalore [30]; Seringapatam [31]; Sivasamudram [32], (Ryley, 1913a); Mercara [33]; Haleri [34]; Wotekolli [35]; Srimangala [36], (Ryley, 1913b); Dharwar [37]; Bellary [38], (Brosset, 1962b) in **Karnataka**; Nilgiri Hills [48], (BMNH coll.) in **Tamil Nadu**; Mandu [39], (Brosset, 1962b) in **Madhya Pradesh**; Hasimara [49], (BMNH coll.); Luia [40], (Wroughton, 1915b); Chota Nagpur [41]; Dhanbad [42], (Sinha, 1986) in **Bihar**; Calcutta [43], (Lal & Biswas, 1984) in **West Bengal**. Extralimital localities based on BMNH coll., Roberts (1977) and Wroughton (1916c); Phillips (1980); type loc. of *ceylonicus* and BMNH coll. in SRI LANKA and Ryley (1914b) for upper BURMA.

bifid, broader than tip; basal lobes curved downwards.

Cranial and dental characters: Skull exceeds that of *P. javanicus babu* and *P. coromandra in* length; cranial profile is slightly convex, raised above the frontal region, with the lambda the highest point; mastoid flanges well developed; rostrum very broad, with conspicuous incurving margins which produce well defined supraorbital ridges; zygomata are delicate; palatal length exceeds width and upper dentition is not convergent; tympanic bullae relatively small and basiocciput relatively broad. Inner upper incisor (i^2) bicuspid, the secondary cusp about three-quarters the height of the principal one; outer incisor (i^3) large, two-thirds height of i^2; canine with posterior secondary cusp; small anterior premolar (pm^2), not greatly reduced, internal to the toothrow, crown area equal to i^3, not visible from without, c^1 and posterior premolar (pm^4) almost in contact; upper molars typical of *Pipistrellus*; lower incisors trifid, slightly imbricated; crown area of posterior premolar (pm_4) slightly exceeds that of anterior (pm_2).

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	54.2	48 - 64	2.9	37
T:	38.1	30 - 45	4.0	38
HF:	8.6	6.5 - 11	1.0	23
FA:	37.6	30 - 42	2.4	31
WSP:	251.0	227 - 262	10.2	12
E:	12.2	9.5 - 17	1.4	35
GTL:	14.9	14.2 - 15.8	0.4	58
CCL:	13.6	12.3 - 15.2	0.4	59
ZB:	9.8	8.9 - 11.0	0.4	35
BB:	7.3	6.6 - 7.8	0.3	59
PC:	4.0	3.7 - 4.3	0.1	59
ROSTRAL B:	6.1	5.3 - 7.0	0.3	57
C-M^3:	5.4	5.0 - 5.7	0.2	59
M^3-M^3:	6.6	5.7 - 7.1	0.3	57
C-M^3:	5.9	5.5 - 6.3	0.2	59
M:	11.1	10.2 - 12.0	0.4	59

Ecology: This is an ecletic species which ranges from the tropical thorn forest of Pakistan to the highlands of central Sri Lanka. It is very common throughout much of its range and is frequently seen in towns and villages. It inhabits old houses and dilapidated buildings where it roosts between wooden rafters and inside cracks in walls and ceilings (Gopalakrishna and Madhavan 1971). Other diurnal biotopes include holes in trees, hollow branches (Phillips 1980), caves, wells, temples and even a roller blind in an hotel (Brosset 1962b). Colony size tends to be small, ranging from a single individual to a maximum of about 200 (Gopalakrishna and Madhavan 1971). It does not hang suspended like the Rhinolophidae but rather clings to the sides with feet and wing claws, while retaining the head-downwards position (Phillips 1980). It is inactive during cold or wet seasons, when individuals become partially torpid (Madhavan 1971).

It appears early in the evening, almost as soon as the sun has set. It does not fly particularly fast or high but continually turns, twists and wheels in flight. As the evening progresses, it often ascends higher and flies rather straighter. It feeds on small beetles and other insects (Phillips 1980).

Biology: In Maharashtra, copulation takes place during the first two weeks of June. The inseminated sperm remains alive inside the female genital tract until about the second week of July when ovulation and fertilisation take place, followed immediately by pregnancy (Gopalakrishna *et al.* 1970).

Gestation lasts about 50-55 days and deliveries take place during the first two weeks of September. Normally each female bears two young; in rare cases there is one young or triplets (Gopalakrishna and Madhavan 1971). The young are carried by the mother for 25-30 days and lactation is concluded by the third week of October.

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Khirasara, Rajkot (18 March)	Uncertain	4	Ruins of old fort

Discussion: Brosset (1962b) studied this species at 15 sites in central and western India. Colony size varied from a single individual to 100-150 at Karla. It was only collected near Rajkot during this recent study. This however reflects the difficulty in locating its diurnal roosts; its feeding pattern also makes for difficulties in catching it in mist nets.

Status: Considered to be extremely common throughout its range (Brosset 1962b).

Miniopteris schreibersii (Kuhl, 1819) — Schreibers' Long-fingered bat

Vespertilio schreibersii Kuhl, 1819: Annalen Wetterau Ges. Naturk., 4(2): 185. Kulmbazer Cave, mountains of Southern Bannat, Hungary.

External characters: A medium-sized Vespertilionid bat with a long tail, interfemoral membrane and hind limbs; wing characterised by a highly developed second phalanx of third finger which is approximately three times the length of the first phalanx; membranes uniformly dark; pelage soft and silky, dark throughout, dorsal surface a rich russet brown in some individuals, others a deeper blackish brown; ventral surface, usually slightly paler with greyer tinge; ears small, with broadly rounded tips which scarcely project above pelage of crown; the tragus is half the height of the pinna, slightly curved forwards; the antitragus is low and ill defined. This is species is usually found with numerous ecto-parasites (Phillips 1980).

Cranial and dental characters: Skull characterised by marked inflation of braincase anteriorly, abruptly elevated above the low, flattened rostrum; rostrum tapered anteriorly, dorsal surface flattened but with a distinct median concavity; mandible slender with posterior parts very small; the coronoid process almost on a level with the condyle. Crown of inner upper incisor oblique, strongly hollowed out postero-laterally and with weak postero-internal secondary cusp; outer incisor flattened, its cingulum forming a minute postero-external cusp; anterior upper premolar (pm^2) unusually large, situated in toothrow, broadly triangular crown, with postero-medial base noticeably expanded; large upper premolar (pm^4) with well defined antero-medial cingular cusp and feeble antero-lateral one; m^1 and m^2 emarginated posteriorly; deep pits between the metacones and paracones and the protocones; m^3 more than half crown area of m^2 with metacone and third commissure well developed; lower incisors trifid, outer tooth distinctly larger; anterior premolar (pm_2) subequal in crown area to the second (pm_3); posterior premolar (pm_4) three-quarters the height of the canine; m_3 with talonid little reduced, more than half width of m_2.

Measurements: Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	
HB:	56.0	47 - 65	5.3	21
T:	54.5	48 - 60	3.7	21
HF:	10.0	7 - 12	1.3	21
TIBIA:	19.2	17.7 - 20.5	0.9	12
FA:	47.4	45 - 50.5	1.7	21
3MET:	43.5	41.1 - 45.4	1.2	14
4MET:	41.7	38.9 - 43.0	1.2	14
5MET:	38.4	36.5 - 40.1	1.0	14
3MET/1PH:	11.2	10.2 - 12.2	0.5	14
3MET/2PH:	35.8	31.2 - 40.0	2.7	14
WSP:	325	322 - 328	-	2
E:	11.3	10 - 12	0.8	21
GTL:	15.7	15.3 - 16.1	0.2	20
CCL:	14.2	13.5 - 15.3	0.4	21
ZB:	8.8	8.5 - 9.3	0.2	17
BB:	7.9	7.5 - 8.5	0.2	21
PC:	3.9	3.7 - 4.1	0.1	21
C-M^3:	6.0	5.7 - 6.2	0.1	20
C-M_3:	6.5	6.2 - 6.8	0.2	21
M:	11.4	11.1 - 11.9	0.2	21

Ecology: *Miniopterus schreibersii* appears to favour hilly and forested country, ranging up to about 2150 metres (7000') in the foothills of the

Fig. 18. *Miniopteris schreibersii* ranges from southern Europe and Morocco through the Caucasus and Iran to Japan, the Indian subcontinent and east to Australia; also subsaharan Africa.

Records from INDIA include Mahableshwar [1], (Wroughton, 1916a); Panchgani [2], (Brosset, 1962b) in **Maharashtra**; Mussoorie [3], (Scully, 1887); Ramnagar [4], (Wroughton, 1914) in **Uttar Pradesh**; Sonari [5], (BMNH coll.) in **Sikkim**. Extralimital records based on Scully (1887) and HZM coll. for NEPAL; BMNH coll., Wroughton (1915a) and Phillips (1924) for upper BURMA and Phillips (1980) for SRI LANKA.

Himalayas (Blanford 1888-91; HZM collection). The colonies are large but extrmely rare; they are situated in caves, caverns and even crevices in rocks (Scully 1887). At Robbers' Cave, near Mahableshwar, Brosset (1962b) estimated there were some 100,000 individuals with a density of about 2000 bats/m^2 ; the majority were in vast swarms, neither segregated by sex or age. There appear to be two types of colonies; the 'mother-colony' which is situated in a large natural cave, usually with a subterranean water source inside and 'secondary colony', situated within 70 km of the mother house and located in caves of much smaller size, here groups of individuals stay periodically. The young are confined to the principal diurnal roost. *Miniopterus* leaves its roost soon after sunset to feed; individuals fly away in many different directions and hunt alone. The diet is probably comprised of small insects, including Diptera and Coleoptera (Brosset 1962b).

Biology: At Mahableshwar, copulation and conception takes place in the second and third week of February. Gestation lasts 120-125 days; females give birth between 15 and 25 June to a single infant weighing about 3 grams; they carry the new-born young for one or two days after which the infants are gathered into communal groups of 100 or more, which they do not leave until they can fly. Lactating mothers visit the groups to suckle the young and according to Brosset (1962b), suckle the first infant that contacts them, sometimes two feed together. Weaning occurs after two months. There is a single breeding cycle and sexual maturity is attained at about 20 months (Gopalakrishna *et al.* 1985/86).

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Robber's cave, Mahableshwar (28 March)	Not known	4	Undergound cave

Discussion: This species was collected at just one site, Robber's Cave. It is not known whether the colony size has changed since the survey of Brosset (1962b).

Status: Although widely distributed, the small number of diurnal roosts within India makes this species vulnerable to disturbance.

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(Concluded)

MOULT IN BABBLERS (*TURDOIDES* spp.)[1]

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Key words: whiteheaded babbler, jungle babbler, post-juvenal moult, body feathers, primaries, secondaries, rectries, breeding and moult, duration.

The juvenile Whiteheaded Babbler *Turdoides affinis* and the Jungle Babbler *Turdoides striatus* undergo partial moult beginning at 3 months after fledging. This moult is complete only in the birds fledged in the early part of the year. In others, the late developing feathers are retained. They undergo a complete moult in the next year. In both the species, there is only one annual moult, and they breed and moult simultaneously. The body feathers start moulting from March to November in the Whiteheaded Babbler and from February to November in the Jungle Babbler. In both species, moult of body feathers proceeds at a slow tempo. Primaries moult from a single focus from late April to October/November in both the species. In both the species secondaries moult from two foci, the tertiaries, irregularly, and the rectrices centrifugal.

Babblers of the genus *Turdoides* live in groups and breed co-operatively. In the Calicut University Campus, these birds breed throughout the year with a lull in July, the month of heaviest rainfall (Gaston *et al.* 1979). They breed and moult simultaneously. The Whiteheaded Babbler *Turdoides affinis* and the Jungle Babbler *T. striatus* co-exist in several parts of South India. The former prefers open dry scrub habitat, while the latter frequents woody areas. We studied the biology of these species of babblers (Zacharias and Mathew 1988) in the Calicut area from 1974 to 1980. An account of their moult is given here.

Materials and Methods

Specimens of the Whiteheaded Babbler and the Jungle Babbler were collected by shooting at a rate of 5-10 per month. The specimens collected for analysis of stomach contents were preserved in 10% formalin or 70% alcohol. All the specimens were collected near the Chelannur area of Calicut and Thenhippalam village of Malappuram. These two areas had the same type of climate, physiographic conditions and layout of crops. Specimens of the two babblers were collected for studying various aspects of biology by different workers over a period of 3 years from a vast area of about 240 sq. km. Particular care was taken to see that no group of babblers was repeatedly used for collection; we very frequently changed sites of collection. These specimens were used for the doctoral theses on ecology and biology by the first author, leg myology and pterylography by Dr. K.V. Jayashree and for two M. Phil. dissertations on comparative appendicular myology by Elizabeth Stephen and Lija Thomas. The remaining specimens were preserved carefully and used for other studies as and when required. After other studies were conducted they were dried in the laboratory and the feather tracts examined carefully. Information on the state of plumage in the birds collected over three years from 1975-1977 was pooled. Data collected from the examination of the plumage of the birds trapped for ringing and those ringed as nestlings, were also used for studying the moult.

Details of moult were recorded on cards. Moult in the body feathers was estimated by counting the number of moulting feathers out of a sample of 30 feathers each in all the body tracts every month. In the humeral, femoral and crural tracts, which had very few feathers the entire tracts were examined to estimate the percentage of feathers moulting. The system and symbols used by Stressemann and Stressemann (1966) were followed for numbering and naming the remiges and rectrices.

Results

Whiteheaded Babbler

Post-juvenal moult: The juvenile undergoes

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a partial or complete moult of its feathers starting about three months after fledging. The post-juvenile moult begins in the frontal region of the capital tract or with the first primary. We did not see any post-juvenile moult between October and April. In many juveniles which fledged late in the year, the dormant papillae of the late developing feathers started proliferating just before or during the post-juvenile moult. It is presumed that some of these were retained during the post-juvenile moult, if they moulted in the year of hatching, and moulted completely if they moulted in the next season. We have not examined a large sample of juveniles to draw any definite conclusion about the above aspect. The feather coat in both the species of babblers never changes colour and there is no sexual dimorphism.

Adult body feathers: In the Calicut area, moult of the adult body feathers in the Whiteheaded Babbler started in March, beginning in the frontal region of the capital tract. Moult of the body feathers was more intensive during the period September to October, but was otherwise a slow and long drawn process which ended in November. The dorsal and ventral tracts took the longest duration to complete renewal. At no time between March and November were more than 50% of the feathers of any of the regions counted moulting.

Primaries: There are ten primaries of which the outermost is the smallest. The moult of the primaries normally started in late April from the first primary and proceeded in the ascending order. Growing of two primaries simultaneously was the usual pattern. There were a few exceptional cases of 3-4 primaries growing simultaneously; these were noted towards the end of the moulting period of the primaries. Most birds had completed their primary moult by the end of October. Primary moult in the population thus covered about 6 months.

Secondaries: There are nine secondaries, of which the innermost is the smallest. The secondaries moulted from two foci i.e., from A1 and A6. The latter sometimes dropped only after A5 had moulted. The secondaries sometimes moulted simultaneously from both ends. Secondary moult usually started when the third primary (H3) was moulting and ended after H10 had been renewed. There were exceptional cases of the secondary moult starting and ending earlier than the beginning and end of primary moult respectively. The moult of tertiaries started in any of its three quills (A7-9). They moulted before, during or after the renewal of the other remiges.

Wing coverts: The upper greater primary coverts moulted in close coordination with their respective primaries. Moulting of several upper secondary greater coverts ahead of the renewal of the respective secondaries was a frequent occurrence.

Rectrices: There are 12 rectrices. The rectrices started moulting when H3 was growing and proceeded centrifugally. After the first pair had completed their growth, rectrices 2-6 moulted rapidly, sometimes as many as 3 pairs of rectrices grew simultaneously. In one third of the cases examined (N = 90) rectrix moult was symmetrical. The large number of cases of asymmetrical moult of rectrices was probably due to the accidental loss of these feathers. Moulting of rectrices was completed either before the completion of the primary moult or along with H10, but in 10% of the cases (N = 90), moulting of the tail feathers continued after the completion of the primary moult.

Alula: The alula was renewed during the span of the moult of the primaries. Alular quills moulted from the proximal to the distal end and in an orderly manner.

Relationship between moult and breeding: Eventhough a clearly marked breeding season was absent in *T. affinis*, two peak periods of egg laying were identified in March/April and November/December (Gaston *et al.* 1979, Zacharias and Mathew 1988). Females with developing eggs collected in May (2)[5], August (2), September (1) and October (1) were all moulting their remiges.

JUNGLE BABBLER

The moult of the Jungle Babbler was studied

[5] Number of females collected in each month are given in brackets.

TABLE 1
COMMENCEMENT AND COMPLETION OF PRIMARY MOULT IN
T. affinis and *T. striatus*

Stages of Primary Moult	Earliest recorded date		Last recorded date	
	T. affinis	*T. striatus*	*T. affinis*	*T. striatus*
Commencement of primary moult	April 26 (1)	April 20-26 (6)	June first week (4)	June 6 (1)
Completion of primary moult	September 28 (1)	August 27 (2)	November first week (4)	November first week (4)

The figures in brackets show the number of specimens examined.

by Naik and Andrews (1966) in Baroda (May to October/November) and by Gaston in Delhi (June-November). In our study area in Calicut *T. striatus* started moulting its body feathers from February. The frontal region of the capital tract was the first to moult. The flight feathers moulted between April and October.

Primaries: The primary moult was orderly, regular and symmetrical. It began in April and ended in November. Unilateral growth of primary feathers simultaneously, probably due to accidental loss of feathers of one wing and cases of 3-4 primaries growing together were also noted occasionally.

Secondaries: The secondaries moulted from both proximal and the distal foci. The sixth secondary and the tertiaries moulted at different times. In 12 out of 29 cases in which the beginning of the tertiary moult was recorded, A8 moulted ahead of A7 and A9. Of these 29, A9 moulted first in 8 specimens and A7 in nine. Secondaries started moulting simultaneously with the primaries in a few cases but usually only after the second primary had moulted. Usually the moult of the secondaries was not completed along with that of the primaries. The tertiaries moulted before, during or after the other remiges were renewed.

The upper greater wing coverts: The upper primary greater coverts moulted in co-ordination with their respective remiges. The secondary upper greater coverts moulted in bunches as in the Whiteheaded Babbler.

Alula: The tail feathers moulted from the centre to the periphery. Unilateral growing of the tail feathers of one side was noticed in four out of 72 cases of rectrix moult. In the rest, the tail feathers moulted symmetrically. Rectrices started moulting after H3 in some cases, but in 50% of the cases only when H3 was moulting. The tail coverts appeared to moult symmetrically. The rectrices completed moulting before the completion of the moult of the primaries or along with them.

Moult in relation to breeding: In our study area the Jungle Babbler bred throughout the year. There were records of egg laying by the birds in all the months except June and July. So moult of feathers and breeding activity in this species were not temporarily separated. The midpoint of the moult coincided with the period of lowest breeding in June and July.

COMPARISON OF MOULT IN THE WHITEHEADED AND THE JUNGLE BABBLER

The first complete moult: Both species undergo their first complete moult in their second year of life. Pattern of this moult and all subsequent moults are identical.

Duration of Moult: Table 1 gives the earliest and last cases of recorded commencement and completion of primary moult in the Whiteheaded and the Jungle Babbler. The moult of the primaries spans almost the entire moulting period. Using the method of Pimm (1976) the duration of primary moult at individual level was crudely estimated to be 16-20

weeks in both the babblers. Gaston (1981) described a shorter duration of primary moult in babblers and some other birds in Delhi. the duration of primary moult in Baroda was not worked out. But at the population level the primary moult in the Jungle Babbler began in May and ended in October/ November in Baroda (Naik and Andrews 1966). In Delhi it was from June to October (Gaston pers. comm.), while in Calicut it was from April to October/ November. In Sarawak, Fogden (1972) recorded the duration of primary moult of individual birds of 18 species, ranging from 17-20 weeks. The duration of moult in the Whiteheaded Babbler and the Jungle Babbler in the study area were slow, compared to temperate birds and some birds of seasonal tropics (Delhi), but similar to the duration for species of moist tropics.

Discussion

The pattern of moult of feathers of the Whiteheaded and the Jungle Babbler were very similar in several respects but differed from that of many other passerine birds. Their pattern of moult is well adapted to their way of life in the study area. As they breed irregularly throughout the year, they have no exclusive breeding and moulting seasons.

At the population level the primaries in the Jungle Babbler moulted from April to October/November, from May to October/ November in Baroda and from June to October in Delhi. The shorter duration of primary moult in Delhi may be related to the climatic conditions there — the severe summer and winter. In Calicut there are no severe extremes of climate except for the heavy rainfall in June-July.

As both breeding and moult of feathers are functions which demand much energy, it may be advantageous to renew feathers at a slow tempo, so that too much strain is not placed on the bird's energy budget at any particular period. In birds which have a breeding-moult overlap, the moult of feathers may be considerably protracted by means of a decrease in the number of feathers growing at any one time or in their rate of growth (Snow and Snow 1964, Newton 1966). Generally the pattern of moult of flight feathers in these two species of babblers agree with the general pattern (Stressemann and Stressemann, op. cit.) for passerine birds. The renewal of tertiaries at times different from the times of renewal of the rest of the remiges is an adaptive feature. According to Stressemann and Stressemann (1966), H7-9 act as guard feathers which cover the rest of the wing feathers in the closed wing. So they should not be weakened by moulting simultaneously with the rest of the feathers. The simultaneous renewal of several upper secondary coverts also should serve the same purpose. However the cases of tertiary moult examined are too few to establish their exact pattern of renewal.

Varying degrees of overlap between breeding and moulting activities were reported in many species of tropical birds like the common Babbler *T. caudatus* (Gaston 1966), the Indian Myna *Acridotheres tristis*, the Bank Myna *A. ginginianus*, the Brahminy Myna *Sturnus pagodarum* (Naik 1970) and the House Swift *Apus affinis* (Naik and Naik 1965).

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TRADITIONAL PHYTOTHERAPY IN THE HEALTH CARE OF GOND TRIBALS OF SONBHADRA DISTRICT, UTTAR PRADESH, INDIA[1]

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Key words: traditional phytotherapy, Gond tribes, Sonbhadra district

The paper describes the traditional indigenous phytotherapy as practised by Gond medicinemen. The information on local name, preparation of ethnomedicine recipes, dosage and mode of their administration, etc. have been discussed. The study provides new knowledge on the traditional uses of 44 medicinal plants, useful database for phytochemists and pharmacologists to determine their active compound after clinical trials for their safe use. There is good potential of medicinal plants in the area needed for establishment of herbal farm for processing and production of herbal medicine as well as generating employment schemes for the benefit of tribal and local population.

Introduction

We were engaged in medico-botanical surveys and studies among the tribal and aboriginal populations of Uttar Pradesh (Maheshwari *et al.* 1981, 1986; Singh and Maheshwari 1989, 1992). In this connection, detailed medicobotany of the Gond tribe of Sonapar tribal area of Sonbhadra district, U.P. with a view to gather information on traditional phytotherapy used by the tribe for meeting their health care was undertaken. The Gonds constitute the principal tribe of the district and have two main sects the 'Raj' and 'Khatolas'. They practice primitive agriculture and grow rice, millets, maize, wheat, barley, lentil, pea, plantain etc. Besides these, they depend on many wild roots, flowers, and fruits. The forests are of tropical dry deciduous type. The vegetation growing in the forest plays a vital role in the life, economy and health care of the tribe. Due to long association with the forests they have learnt to utilize many medicinal plants for treatment of common diseases and disorders prevailing in their communities. Due to urbanisation, acculturation and depletion of plant cover the indigenous knowledge and therapy about the medicinal plants used by the tribe is fast disappearing. It is therefore, considered important to preserve and document the traditional knowledge before it is lost for ever. The ethnomedicinal information presented here has not been recorded earlier (Ambasta 1986, Chopra *et al.* 1956, 1969, Jain 1975, Kirtikar and Basu 1935).

Materials and Methods

During the study, 17 villages inhabited by Gond tribals adjacent to the forest areas were surveyed. The indigenous knolwedge and therapy of medicinal plants used for their health care were gathered from the medicine men, Baigas, Ojhas, Village heads, healers and other old, experienced and knowledgeable informants who were practising indigenous medicine among the Gond communities. The medicine men accompanied us during the survey, collection, and documentation of plants in the forest areas. The ethnomedicinal uses of plants, dosages, and mode of administration were recorded in the field books. The dialogues and discussions with regard to plants used in their daily life were also tape recorded during interviews. The data obtained from different villages and localities on uses of ethnomedicinal plants were compared, scrutinised and are presented here. The voucher specimens and crude samples of medicinal plants are preserved in the ethnobotanical herbarium cum museum of the National Botanical Research Institute, Lucknow, under EBH Number. The species are arranged alphabetically giving information on local name, locality, ethnomedicinal recipes, uses, dosages, mode of administration and voucher specimens number.

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Results

Herbal Drugs

1. *Achyránthes aspera* Linn. (Amaranthaceae)
   Ln. Chirchiri; Loc. Dubha.

   Leaf juice is dropped in the eye twice a day for one month for the treatment of cataract (EBH 9348).
2. *Abrus precatorius* Linn. (Fabaceae)
   Ln. Gomchi; Loc. Jhareeltola.

   Root extract is given 2 teaspoonsful once a day for 3-4 days for the treatment of Syphilis. The extract of the root together with the root extract of *Asparagus racemosus* and plant of *Cuscuta reflexa* is given 1 teaspoonful thrice a day for 3 days after 8th day of menstruation to check conception (EBH 9395).
3. *Adina cordifolia* (Willd. ex Roxb.) Hook. f. ex Brandis (Rubiaceae)
   Ln. Karam; Loc. Raspahari, Jhareeltola, Kundadeh.

   Extract of the stem bark 1 teaspoonful thrice a day for 3 days is given for malarial fever and stomach disorder (EBH 7608, 9307).
4. *Aegle marmelos* (Linn.) Correa (Rutaceae)
   Ln. Bel; Loc. Raspahari, Muirpur, Dubha.

   The extract of the stem bark is given as an antidote for snakebite. Warm leaf paste is applied on inflamed eye, and extract of tender leaf is dropped in the eyes twice a day for 5-10 days for the treatment of inflammation of eyes (EBH 9359).
5. *Alangium salvifolium* (Linn. f.) Wang (Alangiaceae)
   Ln. Dhera; Loc. Chhaga.

   Stem bark along with the stem bark of *Caesalpinia bonduc*, lime, jaggery is made into tablets. 1 tablet thrice a day for 21 days is given for the treatment of asthma (EBH 9389).
6. *Ampelocissus latifolia* (Roxb.) Planch (Vitaceae)
   Ln. Baunhath; Loc. Chhaga.

   The lukewarm root paste is applied on carbuncle boils for suppuration and healing. The stem juice is given 1 teaspoonful twice a day for 15 days for bone fracture (EBH 9390).
7. *Bombax ceiba* Linn. (Malvaceae)
   Ln. Semar; Loc. Jhareeltola, Sahgora.

   The root extract of young plant 1 teaspoonful twice a day for 4 days is given in the treatment of gonorrhoea. 1 teaspoonful powdered gum twice a day for 2 days is given in dysentery (EBH 9393).
8. *Buchanania lanzan* Spreng (Anacardiaceae)
   Ln. Piyar; Loc. Kurchatta.

   Aqueous extract of leaf 1 teaspoonful twice a day for 15 days is given for the treatment of spermatorrhoea (EBH 9357).
9. *Bauhinia vahlii* W. & A. (Caesalpiniaceae)
   Ln. Mohlan; Loc. Dadhiera.

   Aqueous extract of the root 1 teaspoonful thrice a day is given orally for 3 days for the treatment of Syphilis (EBH 9392).
10. *Cajanus cajan* (Linn.) Millsp. (Fabaceae)
    Ln. Rahar; Loc. Kurkuchi.

    The paste of the leaves together with black pepper and butter milk 2 teaspoonful thrice a day for 7 days is given for the treatment of jaundice (EBH 9395).
11. *Calotropis procera* (Ait.) R. Br. (Asclepiadaceae)
    Ln. Mannar; Loc. Dubha.

    Extract of the root is given orally 1 teaspoonful twice a day for 1 day as an antidote for snakebite. Root extract together with stem juice of *Nicotiana* sp., a pinch of lime coal, 1 teaspoonful thrice a day is given for 15 days to treat the enlargement of the spleen. Root garland is tied around the neck for the treatment of insanity (EBH 9396, 9320).
12. *Casearia elliptica* Willd. (Samydaceae)
    Ln. Bheri; Loc. Jhareeltola.

    Root extract is given 2 teaspoonful once a day for 3 days for the treatment of cholera (EBH 9337).
13. *Cassine glauca* (Rottb.) Kuntze (Celastraceae)
    Ln. Namar; Loc. Banvashi Sewaashram, Parni, Muirpur.

    Root bark extract is given orally once a day for 3-4 days for the treatment of rheumatism, gout and dysentery. The fruit paste together with fruit paste of *Xeromphis spinosa*, and wheat flour is given for abortion (EBH 7607, 7637, 9302).
14. *Celastrus paniculatus* Willd. (Celastraceae)
    Ln. Umjan; Loc. Jhareeltola.

Powedered root 1 teaspoonful twice a day for 10 days is given for the treatment of cancer (EBH 9336).

15. *Cryptolepis buchananii* Roem. & Schult. (Asclepiadaceae)

Ln. Lakhan; Loc. Chhaga.

Paste of the root is applied on the fractured bone and wrapped with bamboo pieces for 3-4 days and paste is also given orally twice a day for treating fractured bone. Root extract is given 1 teaspoonful once a day for 8 days to females during monthly period to control menstrual disorder (EBH 9326).

16. *Cyperus scariosus* R. Br. (Cyperaceae)

Ln. Nagar motha, Gondhila; Loc. Muirpur, Banvashi Sewaashram.

The aqueous extract of the tuber of this plant and the leaves of *Cajanus cajan* is given twice a day after 10 days of dog bite. Extract of the tuber is given after 2 hours interval thrice a day as an antidote to snakebite (EBH 7604, 9301).

17. *Dendrophthoe falcata* (Linn.f.) Etting. (Loranthaceae)

Ln. Banjholi; Loc. Jhareeltola, Phullidumer.

The lukewarm juice of the leaves dropped against internal ear pain. Aqueous extract of the plant 1 teaspoonful thrice a day is given for 3 days for control of blood vomitting due to tuberculosis (EBH 9398).

18. *Dillenia pentagyna* Roxb. (Dilleniaceae)

Ln. Korkat; Loc. Dahiera.

Powdered stem bark is applied on cuts (EBH 7628, 7645).

19. *Ficus racemosa* Linn. (Moraceae)

Ln. Gular, Loc. Kurchatta.

The leaf juice together with boiled rice water and jaggery is given twice a day for 1 month for the treatment of paralysis. Sheep butter is applied externally on paralysed portion (EBH 7647).

20. *Ficus religiosa* Linn. (Moraceae)

Ln. Pepper; Loc. Muirpur.

Ash of the stem bark together with stem bark of *Azadirachta indica* and cow dung, mustard oil and Cu So4 is made into ointment. It is applied thrice a day for 15 days for the treatment of Eczema (EBH 7646).

21. *Grewia hirsuta* Vahl (Tiliaceae)

Ln. Gursakari; Loc. Banvashi Sewaashram.

Root extract is given as an antidote for scorpion sting. Paste of the root bark is applied on boils and blisters (EBH 7614, 9360).

22. *Hemidesmus indicus* (Linn.) R. Br. (Asclepiadacea)

Ln. Padhin, Chherdudhia; Loc. Chhaga.

The aqueous extract of the root 1 tablespoonful is given for 9 days for the treatment of diabetes. Root bark is given orally as an antidote for snakebite. Root extract twice a day for 3 days is given for the treatment of fever (EBH 7624, 9309).

23. *Ipomoea carnea* Jacq. ssp. *fistulosa* Austin (Convolvulaceae)

Ln. Behaya; Loc. Kurchatta.

Latex of the plant is applied on scorpion sting (EBH 9340).

24. *Lablab purpureus* (Linn.) Sweet (Fabaceae)

Ln. Sem; Loc. Jhareeltola.

The paste of the leaf together with the latex of the *Calotropis procera*, *Carica papaya* and lime is made into ointment which is applied in various skin diseases (EBH 9344).

25. *Leucas aspera* (Willd.) Link (Lamiaceae)

Ln. Gummi; Loc. Kurchatta.

Root paste is applied on forehead and root powder is sniffed for treating migraine (EBH 9316).

26. *Madhuca longifolia* (Koen.) Macbride var. *latifolia* Chev. (Sapotaceae)

Ln. Koinadori; Loc. Dubha, Muirpur.

Powdered seed cake together with powdered root of *Boerhaavia diffusa* in equal proportion 2 teaspoonful once a day is given as an antidote for snake bite (EBH 9371, 7606).

27. *Momordica charantia* Linn. (Cucurbitaceae)

Ln. Kareli; Loc. Raspahari.

Root extract is given thrice a day for 3 days for the treatment of fever (EBH 7651).

28. *Musa paradisiaca* Linn. (Musaceae)

Ln. Kera; Loc. Kundadeeh.

The paste of the flower together with jaggery, 2 teaspoons twice a day for 5-7 days is given orally in empty stomach after monthly period to females to check conception (EBH 7652).

29. *Ochna pumila* Ham. ex D. Don (Ochnaceae)
Ln. Champa; Loc. Jhareeltola.

Root extract is given thrice a day for 3 days in dysentery and diarrhoea. It is also given for 15-30 days for the treatment of piles (EBH 9338).

30. *Ocimum sanctum* Linn. (Lamiaceae)
Ln. Tulasi; Loc. Kurkuchi.

Powdered leaves along with powder of seeds of *Strychnos nuxvomica*, opium, black pepper and clove are made into pills. 2 pills a day for 10 days is given for the treatment of arthritis (EBH 7653).

31. *Opuntia dillenii* Haw. (Cactaceae)
Ln. Nagphani; Loc. Muirpur.

The ash of dried phylloclade is applied on boils for suppuration and healing (EBH 7654).

32. *Oroxylum indicum* (Linn.) Vent. (Bignoniaceae)
Ln. Dagdagawa; Loc. Jhareeltola.

The decoction of the stem bark together with stem bark of *Madhuca longifolia*, *Mangifera indica* and whole plant of *Achyranthes aspera* is used for taking bath for 3 days in the treatment of jaundice (EBH 7655).

33. *Plumbago zeylanica* Linn. (Plumbaginaceae)
Ln. Chit; Loc. Kurchatta.

The root paste is applied twice a day for 7 days for suppuration of boils (EBH 7656).

34. *Sarcostemma acidum* Voigt (Asclepiadaceae)
Ln. Harsingar; Loc. Jhareeltola.

Aqueous extract of the stem, 2 teaspoonful twice a day for 7 days is given orally for the treatment of bone fracture (EBH 9387).

35. *Sida cordata* (Burm. f.) Borssum (Malvaceae)
Ln. Baharbuta; Loc. Kundi.

The paste of the whole plant 1 teaspoonful twice a day is given for 15 days in chronic veneral diseases (EBH 7636).

36. *Solanum violaceum* Ortega (Solanaceae)
Ln. Bhanta; Loc. Kundi.

Powdered root bark together with root of *Hemidesmus indicus* 1 teaspoonful twice a day for 15 days is given for the treatment of piles (EBH 9312).

37. *Solanum surattense* Burm.f. (Solanaceae)
Ln. Bhejraina; Loc. Jhareeltola.

Root bark is chewed as an antidote for scorpion sting (EBH 9330).

38. *Tephrosia purpurea* (Linn.) Pers. (Fabaceae)
Ln. Sarpokha; Loc. Jhareeltola.

Root is tied on the neck of patient suffering from fever. The powdered root bark along with black pepper is given as antidote for snake bite. The aqueous extract of the plant together with *Calotropis procera* is given as an antidote for snake bite. The powdered root bark once a day is given for 3 days for the treatment of impotency. Lukewarm root paste is applied on hydrocele and the leaf extract of *Boerhaavia diffusa* is also given twice a day in hydrocele. The decoction of the root along with the root of *Stereospermum suaveolens* is given to females after monthly cycle to check conception.

The root extract 1 teaspoonful once a day is given in the treatment of spermatorrhoea for 15 days. The seed paste is also given in the treatment of spermatorrhoea. The stem is used as tooth brush for the treatment of pyorrhoea (EBH 9327).

39. *Tridax procumbens* Linn. (Asteraceae)
Ln. Phoolghas; Loc. Jhareeltola.

Leaf juice is dropped in the eye for treatment of inflammation, once a day for 7 days (EBH 9306).

40. *Woodfordia fruticosa* (Linn.) Kurz (Lythraceae)
Ln. Dhawai; Loc. Kundadeeh.

Root paste is applied externally twice a day for 7 days for the treatment of piles. Extract of the flowers is also given orally 1 teaspoonful twice a day for 7 days for the same purpose (EBH 9397).

41. *Xanthium strumarium* Linn. (Asteraceae)
Ln. Kathua; Loc. Kundadeeh.

Seed oil twice a day for 2-5 days is applied in various skin diseases (EBH 9396).

42. *Xeromphis uliginosa* (Retz.) Maheshwari (Rubiaceae)
Ln. Pedar; Loc. Banvashi sewaashram.

Paste of the stem bark applied on bonefracture for 4-15 days. The aqueous extract of pith of *Cochlospermum religiosum* is also given orally twice a day for 15 days in bone fracture (EBH 7657).

43. *Zingiber officinale* Rosc. (Zingiberaceae)
Ln. Sonth; Loc. Jhareeltola.

The powdered rhizome together with powdered rhizome of *Curcuma longa*, old jaggery and lime is

made into pills. 2 pills a day for 20 days are given for the treatment of tuberculosis (EBH 9399).

44. *Ziziphus mauritiana* Lamk. (RHAMNACEAE)
Ln. Ber; Loc. Phullidumer.

Extract of the root 2 teaspoonful twice a day for 3 days is given for malarial fever (EBH 9311).

DISCUSSION

The Gonds are dependent on medicinal plants growing in nearby forests for treating their diseases. The indigenous knolwedge and efficacy of these medicinal plants has been proven in their community since time immemorial. There is need to follow up with ethnopharmacological screening of the tribal claims, by testing these ethnomedicinal recipes in their crude form, aqueous extract and alcoholic extracts on animal models. There is enormous potential in the district for establishing herbal drug centres for collection, processing, and preparation of ethnomedicine and to develop cultivation, farming and domestication of potential and promising ethnomedicinal plants in social forestry operation for improving the economy of Gond tribe and for human welfare.

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GROUP COMPOSITION, PERCENTAGE SURVIVORSHIP, BIRTH RATE AND POPULATION OF *PRESBYTIS ENTELLUS* IN JAIPUR, RAJASTHAN[1]

REENA MATHUR AND B. RAM MANOHAR[2]

Key words: langur population, Jaipur

Group composition, birth rate, percentage of survival and population growth of *Presbytis entellus* were recorded in temple, tourist, residential and forest/village habitats in and around Jaipur city. It appeared from data that there was a gradual decline in AF:I, AF:J and AF:SA ratio indicating a poor recruitment of breeding individuals. The population of langurs thrived comparatively well in temples.

INTRODUCTION

Macaques and langurs are found almost all over India but knowledge about their countrywide population is scanty and scattered, the status of rhesus population is better known than that of the most primates (Dolhinow and Lindburg 1983). Till 1978 the primate populations specially *Macaca mulatta* and *Presbytis entellus* were under pressure of export but presently they are under various pressures namely deforestation, industrialization, increased agricultural development of their habitat, human habitat, human population growth and commercial trapping (Bishop *et al.* 1981) and the changing attitude of people. In some areas in India the population of rhesus is reported to be declining (Southwick *et al.* 1980) but not much is known about the population trends of langurs. However, a decline in langur population was reported from Dharwar (Sugiyama and Parthasarathy 1969), only at some places their population has remained stable (Mohnot *et al.* 1981) and an increase has only been reported from temple areas (Southwick *et al.* 1983, Southwick and Siddiqui 1983). The urgency to estimate primate abundance in various parts of their range is being emphasised repeatedly in almost all the conferences on primates. The present paper is outcome of such a study done in Jaipur between 1985 and 1987.

STUDY AREA

Jaipur (26°55'N, 75°55'E) is the capital of the state of Rajasthan in India with an area of about 120 sq km. The region is semi-arid and the average annual rainfall is about 600 mm. Maximum temperature goes as high as 44°C during June and minimum could be 4°C in January. Common plant species are *Azadirachta indica*, *Delonix regia*, *Anogeissus pendula*, *Mangifera indica*, *Bauhinia* sp., *Cassia* sp., *Holoptelia* sp., *Bouganvillea* sp., *Polyalthia longifolia*, *Tamarindus indica* and species of *Ficus* and *Acacia*.

METHODOLOGY

During reconnaissance observations, all the groups of *Presbytis entellus* in and around the Jaipur city were located and identified (Mathur and Manohar 1987, 1990). For the present study selected groups were followed for 10-15 consecutive days. The habitat in and around the Jaipur city was differentiated into four types: (i) Temple, (ii) Residential, (iii) Tourist and (iv) Forest/Village. Selected groups in each habitat were observed to estimate population growth, and the birth rates, individuals of study groups were identified according to approximate age, (adults, subadults, juveniles and infant-I and infant-II), sex for group composition and survivorship. The survivorship is the percentage of individuals living at various ages in a population (Emmel 1973), it was calculated by dividing the total number of particular age-sex by total number of animals, multiplied by 100.

Four unimale bisexual groups in four different habitats were censused regularly for twelve months for birth rate which was calculated using the following formula:

$b = It/Ft$

b = Birth rate

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Ft = Total number of adult females observed throughout the year.

It = Total number of infants.

Results

Group composition and survivorship: A total of 1509 langurs were counted in 35 different groups. Twenty three unimale bisexual groups contributed 1179 individuals (Mathur and Manohar 1994). On an average, each unimale bisexual group had 1 adult male, 23.6 adult females, 3.3 subadult females, 10.1 juveniles, 7.2 infants-II and 6.3 infant-I (Table 1). Three multimale bisexual groups added 124 members to the grand total. Their mean group size was 41.3 with a composition of 3.6 adult males, 17 adult females, 5.6 subadult males, 2.3 subadult females, 7.3 juveniles and 5.3 infants (Table 2). Lastly, 9 allmale groups (total 206 members, mean group size 22.9) had an average group composition of 5.3 adult males, 9.6 subadult males and 7.9 juvenile males (Table 3).

Among 1509 individuals there were in all 82 adult males, 104 subadult males, 594 adult females, 83 subadult females, 327 juveniles and 319 infants. Out of 82 adult males 23 lived in unimale bisexual groups, 11 in multimale bisexual groups and 48 in all male groups. But out of the total adult and subadult males (i.e. 186) 135 lived outside bisexual groups in

Table 1
GROUP NUMBER AND COMPOSITION OF UNIMALE GROUPS OF THE HANUMAN LANGUR (*Presbytis entellus*) IN JAIPUR

No.	Place	Habitat	Group	AM	AF	SAM	SAF	JUV	I^2	I^1	Total	Sex Ratio
1.	Govindeo Temple	Temple	GUM I	1	22	0	6	7	5	1	42	1:22
2.	Galta Temple	Temple	G V	1	35	0	3	20	5	12	76	1:35
3.	Gaitore	Tourist spot	GAUM II	1	18	0	3	4	0	5	31	1:18
4.	Gaitore	Tourist spot	GAUM III	1	11	0	0	6	9	0	27	1:11
5.	Jantar Mantar	Tourist spot	JAM	1	18	0	5	5	4	3	36	1:18
6.	Amber Fort	Tourist spot	AUM I	1	34	0	5	23	16	1	80	1:34
7.	Vidhyadhar Garden	Tourist spot	VUM	1	27	0	3	11	3	10	55	1:27
8.	Brahmpuri	Residential Area	GAUM I	1	22	0	2	6	7	4	42	1:22
9.	Bani Park	Residential Area	BPUM I	1	16	0	3	8	6	2	36	1:16
10.	Tilaknagar	Residential Area	TUM I	1	21	0	2	10	1	6	41	1:21
11.	Bapu Nagar	Residential Area	BUM I	1	12	0	1	2	0	4	20	1:12
12.	Durgapura	Residential Area	DUM I	1	12	0	2	6	4	2	27	1:12
13.	Jhotwara	Residential Area	JWUM I	1	10	0	2	2	2	2	19	1:10
14.	Sanganer	Residential Area	SAUM I	1	17	0	1	6	6	7	38	1:17
15.	'C' Scheme	Residential Area	CUM	1	20	0	0	4	9	2	36	1:20
16.	Ambagarh Reserve Forest	Forest/Village	G III	1	49	0	7	34	13	14	118	1:49
17.	Ambagarh Reserve Forest	Forest/Village	G IV	1	43	0	11	14	18	15	102	1:43
18.	Jhalana	Forest/Village	JHUM	1	13	0	3	4	0	0	21	1:13
19.	Sagar I	Forest/Village	SGUM I	1	28	0	2	7	8	6	52	1:28
20.	Sagar II	Forest/Village	SGUM II	1	26	0	3	5	7	11	53	1:26
21.	Khatipura	Forest/Village	KUM I	1	24	0	1	9	11	8	54	1:24
22.	Khatipura	Forest/Village	KUM II	1	27	0	3	11	3	10	55	1:27
23.	Jagatpura	Forest/Village	JGUM	1	38	0	8	30	21	20	118	1:38
	Jaipur			1	23.6	0	3.3	10.1	7.2	6.3	51.2	1:23
	Total individuals:			1179								
	Average group size:			51.2								

TABLE 2
COMPOSITION AND SEX RATIO OF MULTIMALE GROUPS OF HANUMAN LANGUR (*Presbytis entellus*)

No.	Place	Habitat	Group	AM	AF	SAM	SAF	JUV	I[2]	I[1]	Total	AM/AF sex ratio
1.	Govindeo Temple	Temple	GMM II	5	16	8	4	7	5	0	45	1:3.2
2.	Amber Fort	Tourist Spot	AMM II	4	13	2	2	1	3	1	26	1:3.2
3.	Sisodia Garden	Tourist Spot	SMM I	2	22	7	1	14	7	0	53	1:11
				3.6	17	5.6	2.3	7.3	5.3		41.3	1:4.7

Total individuals: 124
Average groupsize 41.3

TABLE 3
COMPOSITION OF ALLMALE GROUPS OF HANUMAN LANGUR
(*Presbytis entellus*)

No.	Place	Habitat	Group	AM	SAM	JUV	Total
1.	Govindeo Temple	Temple	GAM	3	4	7	14
2.	Ghatgate	Residential area	GGAM	5	4	9	18
3.	Tilak Nagar	" "	TAM	8	3	11	22
4.	Bani Park	" "	BPAM II	8	10	5	23
5.	Jhotwara	" "	JWAM I	4	15	3	22
6.	Nahargarh Reserve Forest	Forest/Village	NHAM	5	28	9	42
7.	Durgapura	Residential area	DAM II	4	0	0	4
8.	Ambagarh Reserve Forest	Forest/Village	AM I	8	23	27	58
9.	Ambagarh Reserve Forest	" "	AM II	3	0	0	3
			Mean	5.3	9.7	7.9	22.9

Total Individuals: 206
Average groupsize: 22.9

TABLE 4
GROUP COMPOSITION AND SEX RATIO OF HANUMAN LANGUR GROUPS

No.	Type of group	AM	AF	SAM	SAF	J	I	Total	Sex Ratio AM : AF
1.	Unimale (n =23)	23	543	-	76	234	303	1179	1 : 23
2.	Multimale (n = 3)	11	51	17	7	22	16	124	1 : 4.6
	Total	34	594	17	83	256	319	1303	
3.	Allmale (n = 9)	48	-	87	-	71	-	206	
	Grand Total	82	594	104	83	327	319	1509	

Overall SAM + AM : SAF + AF

1 : 3.6

TABLE 5
SOCIONOMIC AGE SEX RATIO IN BISEXUAL GROUPS

No.	Age and Sex			Ratio		
1.	AM	:	AF	1	:	17.4
2.	AM + AF	:	SA+J+I	1	:	1.07
3.	AF	:	SA+J+I	1	:	1.13
4.	AF	:	J+I	1	:	0.96
5.	AF	:	I	1	:	0.53
6.	AF	:	SA	1	:	0.16
7.	AF	:	J	1	:	0.43

TABLE 6
GROUP COMPOSITION OF BISEXUAL GROUPS IN DIFFERENT HABITATS

No.	Habitat	Total number of individuals						Ratio	
		A/M	A/F	SA/M	SA/F	J	I	AF:J	AF:I
1.	Temple	7	73	8	13	34	28	1:0.4	1:0.2
2.	Tourist	11	143	9	19	64	62	1:0.4	1:0.1
3.	Residential	8	130	-	13	44	64	1:0.3	1:0.1
4.	Forest village	8	248	-	38	114	165	1:0.4	1:0.1

TABLE 7
BIRTH RATE IN UNIMALE BISEXUAL GROUPS IN FOUR DIFFERENT HABITAT

No.	Place and habitat	Type of group and number	Total No. of adult female	Infants born in whole year	Birth rate
1.	Govindeo (Temple area)	Unimale GUM I	26	8	0.3
2.	Brahmpuri (Residential area)	Unimale GAUM I	22	4	0.18
3.	Jagatpura (Forest/Village area)	Unimale JAUM	40	6	0.15
4.	Jantar Mantar (Tourist area)	Unimale JUM	18	6	0.3 = $\bar{X}$ 0.23

TABLE 8

PER CAPITA RATE INCREASE IN THE POPULATION OF HANUMAN LANGURS (1986 - 87)

No.	Year	Group	Place	Habitat	AM	AF	SAM	SAF	JUV	I2	I1	Total Population	Growth rate
1.	1986	GUM I	Govindeo	Temple	1	22	0	6	7	5	1	42	
	1987		Temple		1	24	0	2	7	7	8	49	1.16
2.	1986	GAM III	Govindeo	Temple	3	0	4	0	8	0	0	15	
	1987		Temple		5	0	4	0	2	0	0	11	0.73
3.	1986	G V	Galta	Temple	1	35	0	3	20	5	12	76	
	1987				1	32	0	2	21	10	10	80	1.05
4.	1986	JUM	Jantar	Tourist	1	18	0	3	4	5	5	36	
	1987		Mantar	spot	1	18	0	3	7	7	6	42	1.16
5.	1986	AUM I	Amber	Tourist	1	34	0	5	23	16	1	80	
	1987		Fort	Spot	1	34	0	6	26	12	10	88	1.10
6.	1986	VUM	Vidhyadhar	Tourist	1	27	0	3	11	3	10	55	
	1987		Garden	spot	1	26	0	1	10	4	13	55	1.00
7.	1986	SMM I	Sisodia	Tourist	2	22	7	1	14	7	0	53	
	1987		Garden	spot	1	22	0	1	5	0	7	36	0.67
8.	1986	BUM	Bapu Nagar	Residen-tial area	1	12	0	1	2	2	2	20	
	1987				1	12	0	1	2	4	3	23	1.15
9.	1986	GAUM	Brahmpuri	Residen-tial area	1	22	0	2	6	7	4	42	
	1987				1	20	0	2	8	7	6	44	1.04
10.	1986	TAM II	Tilak Nagar	Residen-tial area	8	0	3	0	11	0	0	22	
	1987				12	0	3	0	14	0	0	29	1.31
11.	1986	DUM I	Durgapura	Residen-tial area	1	12	0	2	6	4	2	27	
	1987				1	12	0	2	6	3	2	26	0.96
12.	1986	JWUM I	Jhotwara	Residen-tial area	1	10	0	2	2	2	2	19	
	1987				1	10	0	3	1	3	2	20	1.05
13.	1986	SAUM	Sanganer	Residen-tial area	1	17	0	1	6	6	7	38	
	1987				1	16	0	1	6	5	9	38	1.00
14.	1986	GGAM	Ghatgate	Residen-tial area	5	0	4	0	9	0	0	18	
	1987				4	0	2	0	9	0	0	15	0.83
15.	1986	BPUM	Bani Park	Residen-tial area	1	16	0	3	8	6	2	36	
	1987				1	14	0	3	4	4	0	26	0.72
16.	1986	'C' UM	'C' Scheme	Residen-tial area	1	20	0	0	4	9	2	36	
	1987				1	24	0	0	2	4	1	32	0.88
17.	1986	JHUM	Jhalana	Forest/	1	13	0	3	4	0	0	21	
	1987			Village	1	11	0	3	4	0	3	22	1.04
18.	1986	SGUM I	Sagar	Forest/	1	28	0	2	7	8	6	52	
	1987			Village	1	28	0	2	5	9	8	53	1.01
19.	1986	JGUM	Jagatpura	Forest/	1	38	0	8	30	21	20	118	
	1987			Village	1	38	0	9	32	22	23	125	1.06
20.	1986	KUM I	Khatipura	Forest/	1	27	0	3	11	3	10	55	
	1987			Village	1	27	0	3	14	6	12	63	1.14
													$= \bar{X} 1.003$

allmale groups (Table 4). Sex-ratio between adult males and adult females of unimale bisexual groups was 1:23. If all the females (adults and subadults) and all the males (adults and subadults) of all three types of groups were added then the sex-ratio was 1:3.6 (Table 4). The socionomic sex and age ratio in bisexual groups (unimale and multimale) between AF:I was 1:0.53, whereas, the ratio between AF:SA and AF: J was 1:0.16 and 1:0.43 (Table 5). Maximum number of infants were observed in forest/village habitat followed by residential, tourist and least in temple areas (Table 6). Percentage of different age-sex classes were calculated for survivorship. Percentage of adult males was more in the residential area as compared to other habitats. Adult female survivorship was highest in the forest/village (46.5%). Percentage of subadult males was more in residential area whereas, subadult females and juveniles percentage was highest in temple areas (73% subadult females, 23.1% juvenile). The highest percentage in the langur groups was that of adult females followed by juveniles, infants-I, subadult males, adult males and lastly subadult females.

Monthly census of unimale bisexual groups in different habitats for birth rate: Between 1986 to March 1987 eight infants were born in GUM, four in GAUM, six each in JUM and JAUM and the birth rate was calculated as 0.3, 0.18, 0.3 and 0.15 respectively. The average birth rate for Jaipur langurs in one year was 0.23 (Table 7).

Population growth: The per capita rate of increase in group size, i.e. population growth λ was estimated in twenty langur groups in different habitats. Three groups in temple area (GUM, GAM III and G V), four groups from tourist area (JUM, AUM I, VUM and SMM I) nine groups in residential area (BUM, GAUM, TAM II, DUM I, JWUM I, SAUM, GGAM, BPUM and 'C'UM) and four groups from forest/village, namely JHUM, SGUM I, JGUM and KUM I were censused in 1986 and then in 1987 for population growth. The mean value of lambda in temple, tourist, residential and forest/village was 0.98, 9.8, 0.99 and 1.06 respectively. The mean value of lambda was 1.003 (Table 8).

Discussion

In the present investigation, birth rate, survival of infant and AF:J ratio were highest in temple and tourist areas perhaps due to high rate of provisioning, and complete protection from religious beliefs. Similar type of results for rhesus were reported by Southwick and Siddiqi (1977).

A comparison of mean group composition of bisexual groups of Jaipur with other research sites indicated much higher number of females (17.4) to each adult male. The sex ratio for *Presbytis entellus* is reported to vary with habitat (Poirier 1988). Laws and Laws (1984) reported 1:4 male to female ratio in four bisexual groups. Jay (1965) had noted 1:1.5 to 2 for Kaukori and Orcha langurs. Hrdy (1977) noted 1:8 for Mount Abu. Roonwal and Mohnot (1977) noted that the range of socionomic sex ratio for *Presbytis entellus* varies from 1:1.5 to 1:9 with the average in the range of 1:1.5 to 2. In the present investigation the sex ratio between SAM + AM (subadult male + adult male) : SAF + AF (Subadult female + adult female) was 1:3.6 (Table 4). The socionomic sex and age ratio of langurs of bisexual groups of Jaipur showed a gradual decline in AF:I, AF:J and AF:SA ratio indicating a poor recruitment of breeding individuals in their population. The ratio of AF:I reflects potential recruitment to the population if mortality factors do not operate. AF:SA's ratio on the other hand, shows the actual rate of addition to the breeding population after considering mortality factors that have operated. A comparison of data with other research sites suggested that the population of langurs in Jaipur are breeding better than langur population at Bhimthal, Bundala, Dharwar, Kanha, Polonnaruwa, Raipur, Ranthambhore, Wilpattu (Refer Table in Moore 1985).

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AESTIVATION OF TURTLES IN KEOLADEO NATIONAL PARK, BHARATPUR WITH SPECIAL REFERENCE TO *LISSEMYS PUNCTATA* (REPTILIA : TRIONYCHIDAE)[1]

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(With a text-figure)

Key words: *Lissemys punctata*, aestivation, critical temperature, Bharatpur

The aestivation of the Indian flapshell turtle, *Lissemys punctata* was studied in Keoladeo National Park, Bharatpur between January and June 1987. Plots were laid in dried up marshes to locate and study the aestivating turtles. *Lissemys punctata* spent about 160 days in aestivation and the aestivation depth of the turtle varied from 2 to 10 cm with a mean of 5.20 cm (n = 304). Bushes near the drying water body had the highest concentration of 166 turtles/ha. Overall, the highest density of aestivating *Lissemys punctata* (75 turtles/ ha) were observed within 50 m radius of the drying water body. Diurnal substratum temperature in the aestivating habitats varied from 28° to 48°C.

Introduction

Ecological studies on Indian freshwater turtles are few. The Indian flapshell turtle, *Lissemys punctata* is one of the most wide spread turtle species of the Indian subcontinent and inhabits ponds and shallow waterbodies (i.e. non-perennial/ fluctuating habitats). Despite its commonness, only some aspects of its biology have been worked out. Most reptiles reduce their activity during extreme climatic conditions and undergo hibernation or aestivation. This is one of the physiological strategies for surviving and for avoiding predators. It is reported that apart from desert reptiles, many tropical and temperate forms such as turtles burrow and remain dormant until rain occurs (Gregory 1982). Some species such as the American mud turtle, *Kinosternon subrubrum* travel overland during summer in search of suitable aestivation sites when waterbodies dry (Bennett *et al.* 1970). However, studies on the terrestrial activity of aquatic turtles are scanty and restricted to Western countries. This study examines the aestivation behaviour of *Lissemys punctata.* The following aspects were covered; aestivation habitat, duration, depth and substratum temperature. The study was conducted in Keoladeo National Park (KNP), Bharatpur between January and June 1987, when the Park experienced severe drought.

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Methods

The K.N.P., Bharatpur is a non-perennial wetland situated in the flood plains of the rivers Banganga and Gambir. The total area of the Park is 29 sq. km and the aquatic area during winter is about 8.5 sq. km. During summer, especially in drought years, water spread recedes to a few hectares exposing aquatic fauna to severe predation. Detailed information on the flora and fauna of the Park is available elsewhere (Vijayan 1987, 1991).

Plots of varying size (*c.* 50 x 50 m) were laid throughout the dried aquatic area and intensely searched for aestivating turtles. A stick with a pointed metal tip was used in locating the buried reptiles. Burrowing turtles in drying marsh were located by the presence of a breathing hole and in grass and other habitats by the disturbed nature of the surface. The following details were recorded at each location of an aestivating turtle: (1) name of the species, (2) microhabitat and (3) aestivation depth (from soil surface to the carapace of the aestivating turtle). Microhabitat classification was based on the plant cover and moisture content in the soil. A digital thermometer was used to record the atmospheric and substratum temperature of the turtle aestivation site. Temperature was recorded every hour from 0600 to 1800 hrs for two days in the first half of June 1987 to determine the temperature tolerance of *Lissemys punctata.* The aestivating turtles were also monitored to record the aestivation duration.

Results and Discussion

Turtle fauna of the Keoladeo National Park, Bharatpur: Seven species of freshwater turtles have been recorded from KNP, Bharatpur. They are, 1. Indian flapshell turtle (*Lissemys punctata*), 2. Indian softshell turtle (*Aspideretes* (*Trionyx*) *gangeticus*), 3. Indian peacock softshell turtle (*A. hurum*), 4. Indian roofed turtle (*Kachuga tecta*), 5. Indian tent turtle (*K. tentoria*), 6. Crowned river turtle (*Hardella thurjii*) and 7. Spotted pond turtle (*Geoclemys hamiltonii*). The first three species are softshells and remaining are hardshells.

Turtle aestivation in K.N.P., Bharatpur: A total of 7.9 ha were surveyed and 319 aestivating turtles were recorded. All species, except *K. tecta* and *K. tentoria* were recorded in the survey plots. However, turtles of all species, except *Lissemys punctata* stayed temporarily in the drying mud and they either deserted their aestivation site or were found dead after about one month (Table 1). *Lissemys punctata* stayed in the aestivation site until normal conditions returned (i.e. till the monsoon). Hence, only *Lissemys punctata* should be considered as a truly aestivating species in the KNP, Bharatpur. *Kachuga* spp. are basically riverine species which could be the reason for not aestivating. Aestivation of *Lissemys punctata* inhabiting semipermanent waterbodies has already been reported by Daniel (1983). Similar to *Lissemys punctata*, aestivation has been reported in the American mud turtle, *Kinosternon flavescens* (Seidel 1978).

Table 1
TURTLE AESTIVATION IN KEOLADEO NATIONAL PARK, BHARATPUR

Turtle species	Number recorded	Mean aestivation depth (cm)	Maximum aestivation (in days)
Geoclemys hamiltonii	1	1	23 (1)
Hardella thurjii	9	3.63	32 (9)
Trionyx spp.	27	11.87	49 (5)
Lissemys punctata	304	5.20	160 (20)

No. in parenthesis is number of turtles monitored.

Aestivation of *Lissemys punctata*

Aestivation habitat: In KNP, Bharatpur five types of turtle aestivation habitats was distinguished during the present study. They were bushes, *Eicchornia*, grass, soft mud and dried mud. The distribution of the grass habitat was throughout the study area, whereas the other habitats were restricted mostly within 50 m of the vicinity of water. Hence, turtles observed in a 50 m radius from the existing water body were taken for analysis. Among the five habitats recorded, grass was the commonest (40.5%) and soft mud the least (1.78%). The area surveyed in each habitat type is given in Table 2. A total of 304 aestivating *Lissemys punctata* were recorded in the intensive survey plots (i.e. in 7.9 ha). About 82% (249) of the turtles were recorded in the plots of 50 m radius of the last remaining waterbodies which accounted for 3.33 ha (42.2%) of the sampled area.

A high density of aestivating turtles, 950 turtles/ha was recorded in the soft mud habitat (Table 2). This was a temporary habitat and in due course, this dried mud became unsuitable for aestivation. Aestivating turtles in the soft mud deserted this habitat when it became dry and lost moisture drastically and cracked. No cover was available and aestivation in open dried mud in such a concentration seemed risky, as an efficient predator can easily find the hiding prey (Bennett *et al.* 1970). Hence, turtles aestivating in this habitat might have abandoned it when it dried up.

The more stable habitats such as bushes adjacent to the drying marsh had the highest density

Table 2
DENSITY OF AESTIVATING *Lissemys punctata* IN THE VICINITY OF 50 M OF EXISTING WATER

Habitat	Area	Aestivating turtle	
		Number	Density
Bushes	0.410	68	166
Eichhornia	0.761	57	75
Grass	1.361	67	49
Slushy mud	0.060	57	950
Dried mud	0.740	0	-

of 166 *Lissemys punctata* per ha. This is mainly because, these habitats had sufficient moisture and cover which saved the turtles from dessication and predation.

Aestivation duration and site fidelity: After selecting a suitable aestivation site, turtles stayed there for the rest of the dry season. *Lissemys punctata* is adapted to xeric conditions and was observed aestivating for more than 160 days (Table 1). Other species mostly abandoned or were found dead in the aestivation site within a month, indicating that turtles other than *Lissemys punctata* are not adapted for aestivation or to withstand prolonged drought conditions. Bennett *et al.* (1970) report that *Kinosternon subrubrum* left aestivation sites within 5-7 days in search of new sites.

Among the turtles recorded in KNP, only *Lissemys punctata* is adapted to fluctuating or semipermanent habitats (i.e. ponds, shallow water bodies, etc.) and changing water conditions. *Lissemys punctata* was observed emerging out of the drying water body well before the pond disappeared. However, other species did not leave the water till the water body became totally dry. *Lissemys punctata* is a moderate sized turtle and prone to higher predation. Hence, aestivation during dry season would be beneficial for *Lissemys punctata* to protect itself from heat (dessication) and predators. Other species recorded in K.N.P. are two *Aspideretes* spp. (softshells) which are larger in size and the remaining are hardshells and might have higher chances of survival from avian predators while staying in a drying waterbody. Also, *A. gangeticus* was observed feeding on *Lissemys punctata* during summer when the water level was low (Bhupathy 1990). The White scavenger vulture (*Neophron percnopterus*) has been recorded as a major predator of *Lissemys punctata* in K.N.P. (Bhupathy and Vijayan 1989). Also, herons, storks, jackals and stray dogs fed on turtles in this study area.

Aestivation depth: *Lissemys punctata* buries itself in a suitable substratum for aestivation till the next monsoon. The depth varied from 2 to 10 cm with a mean of 5.20 cm (n = 304, Table 1). Auffenburg (1981) and Das (1991) have recorded this depth as 3-6 cm. There appears to be a relation between the neck length and aestivation depth of turtle species. The turtle species having the longest neck (in the study area), *Aspideretes* spp. buried themselves deep in the soil (i.e. 12 cm) as against the short necked hardshells 1-3 cm (Table 1).

TABLE 3

RELATIONSHIP BETWEEN DISTANCE FROM THE EXISTING WATER BODY AND AESTIVATING *Lissemys punctata*

Distance (Metre)	Area (ha)	Aestivating turtle	
		Number	Density
<50	3.33 (42.2)	249 (81.9)	75
100	1.61 (20.5)	26 (8.5)	16
200	1.47 (18.6)	25 (8.2)	17
300	0.86 (11.0)	4 (1.3)	5
400	0.61 (7.7)	0	-

Number in parentheses are percentage.

Turtle aestivation and distance from drying water body: The highest density of aestivating turtles was recorded within a 50 m radius of the last remaining waterbodies. As the distance increased, the density of aestivating reptiles decreased (Table 3). At about 400 m aestivating turtles were not recorded. This might be due to the fact that whenever turtles emerged from a drying water body (i.e. 0 m), they were immediately attacked by predators such as the White scavenger vulture (Bhupathy and Vijayan 1989). Hence, turtles were forced to aestivate nearby drying marsh and had no chance to move far away. This is supported by the fact that about 75% of the predation on this species was observed within 100 m of a drying waterbody (Bhupathy and Vijayan 1989). However during monsoon, turtles were observed emerging from woodland forest, which was about one kilometer away from the last remaining water body. This may have resulted from crepuscular or nocturnal movement overland of some turtles when most of its predators are inactive.

Turtle aestivation and temperature: Diurnal temperature monitored in the aestivation sites of turtles in different habitats showed that in the early

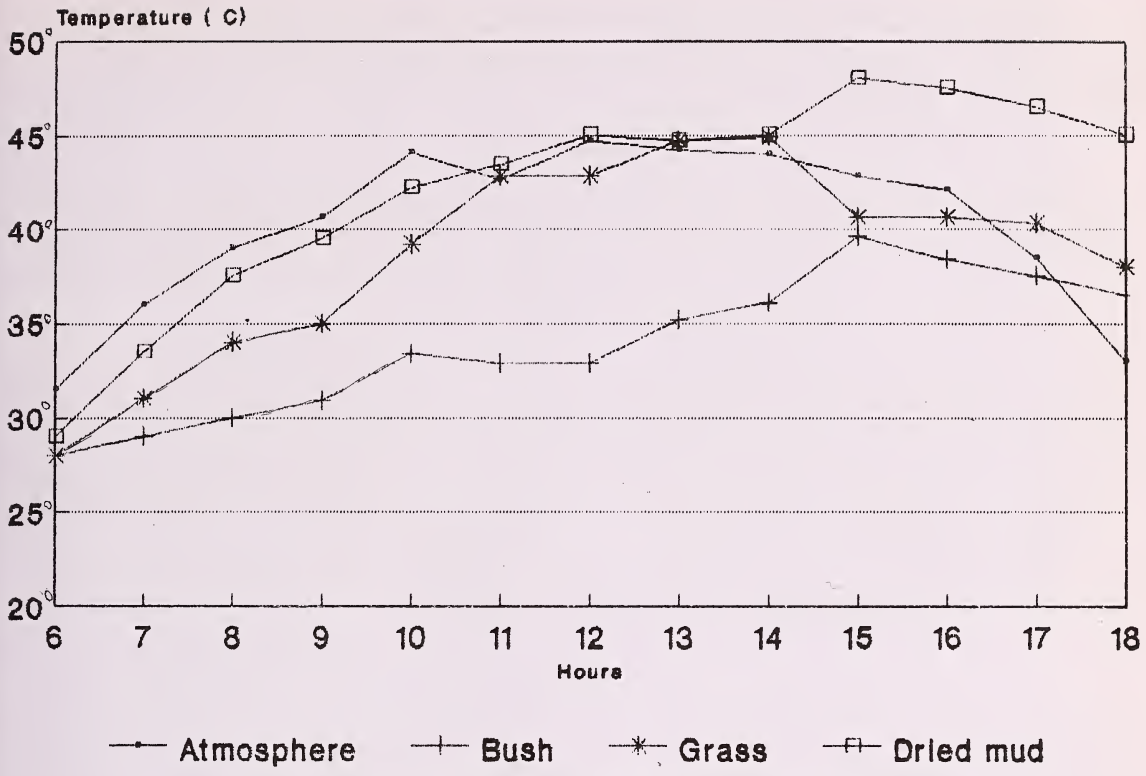

Fig. 1. Temperature recorded in various aestivation habitats of *Lissemys punctata.*

hours of the day, substratum temperatures were similar in different habitats (i.e. 29°C). However, substratum temperatures in open habitat (drying marsh) rose steadily reaching a peak (48°C) at 1500 hrs and remained above 45°C till 1800 hrs. (Fig. 1). On the other hand, under bushes, the substratum temperature reached a peak of 40°C and never exceeded the atmospheric temperature (Fig. 1). It is reported that the Maximum Critical Temperature (MCT, i.e. the thermal point at which locomotory activity becomes disorganised and leads to death) for Trionychid turtles is 40°C (Hutchinson 1982). Hence, habitats with cover are better for aestivation and in the present case it is bushes, as the temperature never exceeded 40°C. However, turtles were observed aestivating in harsher habitats such as grass. The present observations show that the wild *Lissemys punctata* has a considerably higher temperature tolerance.

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THE CHECKERED BEETLES OF NEPAL (COLEOPTERA : CLERIDAE)[1]

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Key words: Coleoptera, Cleridae, Nepal

Four species of Cleridae are recorded from Nepal for the first time: *Cylidroctenus birmanicum* (Gorham), New Combination; *Opilo sordidus* (Westwood); *Orthrius corporaali* (Winkler), New Combination; and *Stigmatium mutillaecolor* (White); New Record. The genus *Tillopilo* Winkler (type-species *T. corporaali* Winkler) is synonymized with the genus *Orthrius* Gorham (type-species *O. cylindricus* Gorham), New Synonymy. *Tillopilo discoidalis* (Fairmaire) from China is transferred to the genus *Tillus* Olivier, New Combination. A key to the 11 species of Cleridae known from Nepal is provided. For each species, a complete bibliography, type locality, type repository, brief diagnosis, and distributional data are provided.

INTRODUCTION

I was recently given a small collection of Cleridae from Nepal which increased the number of species known from this country by four. I thought that a summary of the present state of knowledge of Cleridae in Nepal would be beneficial to collectors and those interested in forest entomology. For each species, complete bibliographic information, type locality, location of type specimens, a brief diagnosis, and distributional data are provided below. The information given here will doubtless have to be updated as more material becomes available for study.

KEY TO CLERIDAE OF NEPAL

1. Procoxal cavities closed posteriorly (Subfamily Tillinae) 2
- Procoxal cavities open posteriorly 5
2. Metatibiae strongly swollen ..... *Diplopherusa rosti* (Schenkling)
- Metatibiae not strongly swollen 3
3. Antennomere 3 serrate ..... *Gracilotillus fasciatus* (Schenkling)
- Antennomere 3 cylindrical 4
4. General form elongate, slender; elytra densely striatopunctate; head and pronotum red, elytra yellow ..... *Orthocladiscus longipennis* (Westwood)
- General form robust; elytra feebly striatopunctate, shining; head and pronotum black; elytra black laterally and brown medially, with a lateral white macula ..... *Cylidroctonus birmanicum* (Gorham)
5. Antennae very small, not attaining base of pronotum, usually with fewer than 11 segments; elytra elongate, flattened, metallic blue (Subfamily Phyllobaeninae) 6
- Antennae large, attaining base of pronotum, always with 11 segments; elytra elongate or robust, usually rounded, not metallic blue (Subfamily Clerinae) 8
6. Elytra with six patches of grey or white pubescence 7
- Elytra with four patches of white pubescence ..... *Callimerus benedictus* Gorham
7. Apical patch of pubescence on elytra round, not attaining suture, comprised of dense white pubescence ..... *Callimerus albovarius* (Westwood)
- Apical patch of pubescence on elytra tiangular, attaining the suture, comprised of sparse grey pubescence ..... *Callimerus amabilis* Gorham
8. Eyes coarsely granulate (facets having diameter 0.30 mm or greater) 9
- Eyes finely granulate (facets having diameter less than 0.30 mm) 10
9. Terminal segment of maxillary palpi triangular ..... *Opilo sordidus* (Westwood)
- Terminal segment of maxillary palpi elongate, not triangular ..... *Orthrius corporaali* (Winkler)
10. Elytra with large, coarse punctures at base alternating with small tubercles ..... *Stigmatium mutillaecolor* (White)
- Elytra finely punctate at base, lacking tubercles ..... *Thanasimus himalayensis* Stebbing

1. **Diplopherusa rosti** (Schenkling)

References: Schenkling 1908:362 (*Cladiscus*); Corporaal 1939: 19 (*Cladiscus*); Corporaal and Van Der Wiel 1948: 183, 185; Corporaal 1950: 20.

Type locality: Western Himalayas.

Type specimen: Deutsche Entomologische Institut, Berlin.

Diagnosis: The enlarged metatibiae will distinguish this species from all other sympatric Cleridae; head and elytra black, pronotum medially red, laterally black; length 8.0 mm.

Distribution: Known only from the Western Himalayas.

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2. **Gracilotillus fasciatus** (Schenkling)

References: Schenkling 1908:362 (*Cladiscus*); Corporaal 1939:19 (*Cladiscus*); Corporaal and Van Der Wiel 1948:181, 183; Corporaal 1950:20.

Type locality: Western Himalayas.

Type specimen: Deutsche Entomologische Institut, Berlin.

Diagnosis: Head black; pronotum and scutellum red; elytra black with a narrow transverse yellow macula and/or base of elytra red; length 5.0 to 8.0 mm.

Distribution: Northern India to Western Himalayas.

3. **Orthocladiscus longipennis** (Westwood)

References: Westwood 1849:52 (*Cladiscus*); 1852:39 (*Cladiscus*); Gorham 1876:62 (*Cladiscus*); Schenkling 1908:362; Corporaal 1939:20; Corporaal and Van Der Wiel 1948:158-188; Corporaal 1950:21.

Type locality: Himalayas.

Type specimen: Hope collection, Oxford University.

Diagnosis: Large, robust; covered with dense black pubescence; head and pronotum red; elytra yellowish-brown; length 15.0-20.0 mm.

Distribution: From Northern India throughout the Himalayan region.

4. **Cylidroctonus birmanicum** (Gorham) New combination and new record

References: Gorham 1892:729 (*Tillus*).

Type locality: India.

Type specimen: Museo Civico di Storia Naturale, Genova.

Diagnosis: Integument predominantly black; eltyra brown along suture, with a white arcuate median fascia; pronotum and elytral apices robust; length 8.0-12.0 mm.

Discussion of new placement: This species does not belong in the genus *Tillus* Olivier as redefined by Gerstmeier and Kuff (1992: 57-59); it is my opinion that it rather belongs to the genus *Cylidroctonus* Kraatz.

Distribution: Found throughout much of India. This is the first record of this species from Nepal; my material is from Amelkghanj, Nepal.

5. **Callimerus albovarius** (Westwood)

References: Westwood 1849:50 (*Xylobius*); 1852:40 (*Clerus*); Gorham 1876:65; Corporaal 1950:84.

Type locality: Himalayas.

Type specimen: Hope collection, Oxford University.

Diagnosis: Superficially similar to *C. amabilis*, differing in the details of the apical elytral patch of pubescence (as described in key).

Distribution: Known only from the type locality.

6. **Callimerus amabilis** Gorham

References: Gorham 1876:66; Schenkling 1915:111; Corporaal 1939:39; 1950:84.

Type locality: Himalayas.

Type specimen: Gorham Collection, Museum National d'Histoire Naturelle, Paris.

Diagnosis: Very dark bluish-black, legs yellow; elytra coarsely punctate at base; pronotum with white pubescence at apex and base; elytra with six patches of white pubescence, two on the basal third, one medial, two at apical third, one at apices; length 12.0-15.0 mm.

Distribution: Generally distributed from Nepal to southern China.

7. **Callimerus benedictus** Gorham

References: Gorham 1893:573; Corporaal 1950:85.

Type locality: Assam.

Type specimen: Gorham Collection, Museum National d'Histoire Naturelle, Paris.

Diagnosis: Very dark bluish-black, shining, legs yellow; elytra coarsely punctate at base; pronotum with scattered basal and apical white pubescence;

elytra with four patches of white pubescence, one basal, two medial, one apical; length 8.5 mm.

Distribution: From Northern India into the Western Himalayan region.

8. **Opilo sordidus** (Westwood)
New record

References: Westwood 1852:42 (*Opilus*); Corporaal 1926:212; 1939:23; 1950:113.

Type locality: India.

Type specimen: Hope collection, Oxford University..

Diagnosis: Head, pronotum, femoral apices, tibiae, tarsi, and ventrum dark reddish-brown; base of femora and elytra (with the exception of irregular reddish-brown maculae along the suture) yellowish-brown; length 15.0-20.0 mm.

Distribution: Previously known only from India. This is the first record of this species from Nepal; my material is from Sangda, Nepal.

9. **Orthrius corporaali** (Winkler)
New combination and New record

References: Winkler 1958:245-248 (*Tillopilo*).

Type locality: Tienmuschan, Northwest China.

Type specimen: Winkler Collection, Prague.

Diagnosis: Uniformly reddish-brown, covered with dense brown pubescence; elytra with small punctures in rows; length 8.0-11.0 mm.

Distribution: Previously known only from the type locality. This is the first record of this species from Nepal; my material is from the Arun Valley, Nepal.

Note on new combination: The three specimens of this species which I have examined from Nepal are all extremely similar to the illustrations and description of *Tillopilo corporaali* provided by Winkler (1958:245-248); however, they clearly belong to the subfamily Clerinae, not Tillinae as claimed by Winkler, as their procoxal cavities are not closed posteriorly. Furthermore, these specimens belong to the clerine genus *Orthrius* Gorham as defined by Schenkling (1903:45) and Chapin (1924:211). I therefore have no difficulty in synonymizing Winkler's genus *Tillopilo* (type-species *T. corporaali* Winkler) with *Orthrius* Gorham (type-species *O. cylindricus* Gorham). The additional species included in *Tillopilo* by Winkler [*Tillopilo discoidalis* Fairmaire)] may be returned to the genus *Tillus* Olivier [type-species *T. elongatus* (Linnaeus)], New combination; I have examined the holotype of this species at the Museum National d'Hostoire Naturelle in Paris and judge it to be congeneric with *T. elongatus* (L.)

10. **Stigmatium mutillaecolor** (White)
New record

References: White 1849:51 (*Tillicera*); Chevrolat 1876:5; Gorham 1876:5; 1892:740; Schenkling 1932:25; Corporaal 1939:27; 1950:171.

Type locality: Bengal.

Type specimen: The Natural History Museum, London.

Diagnosis: Integument largely black, abdomen and base of elytra red; pronotum basally and apically with dense reclinate white pubescence; elytra with two broad transverse bands of reclinate white pubescence; length 10.0-15.0 mm.

Distribution: Generally distributed from central India through Southeast Asia to Western China. This is the first record of this species from Nepal; my material is from Amelkghanj, Nepal.

11. **Thanasimus himalayensis** Stebbing

References: Stebbing 1914:186, 508; Corporaal 1926:213; 1939:26; 1950:142.

Type locality: Himalayas.

Type specimen: The Natural History Museum, London.

Diagnosis: Integument predominantly black; basal third of elytra reddish-orange; elytra with two transverse bands, somewhat recurved on disc; length 10.0-12.0 mm.

Distribution: Northern India throughout the Himalayan Region.

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COMPOSITION OF RAJASTHAN FLORA[1]

ALKA AWASTHI[2]

(With a text-figure)

Keywords: phytogeography, floristic element, flora, Rajasthan

The flora of Rajasthan comprises 1714 species belonging to 728 genera and 139 families. The largest families of the flora studied are Poaceae, Fabaceae and Asteraceae. Thirty-six families are monotypic in this region. The largest floristic element in the flora is the Indian element followed by the Palaeotropical element. Within the Palaeotropical kingdom, this region shows greater affinity with the Indo-Malaysian subkingdom than with the African subkingdom.

INTRODUCTION

Several contributions on enumeration of taxa, phytogeography, additions to flora, extended ranges, monographs, notes on ecology, economic importance, forest and grassland management, plant introduction, vegetation types, etc., have appeared from time to time (Jain 1970, Shama 1980). The floras of different regions of the State which have been published, include *Flora of the Indian Desert* (Blatter & Hallberg 1918-21), *Flora of Indian Desert* (Bhandari 1978, revised 1990), *The flora of North East Rajasthan* (Sharma & Tiagi 1979), *Flora of Banswara District* (Singh 1983), *Flora of Tonk District* (Shetty & Pandey 1983), *Flora of Rajasthan - Series Inferae* (Sharma & Sharma 1989), Shetty & Singh's *Flora of Rajasthan* which appeared simultaneously while this study was being conducted, is still incomplete. The present study is the first report on taxa occurring in the whole of the State and their phytogeography.

Area: The State of Rajasthan is situated in the north-western part of the country occupying about 11 per cent of its total area. The most prominent feature of Rajasthan are the Aravalli Ranges which separate the Saharo-Rajasthan Desert from the semi-arid region.

The region is characterised by extremes of atmospheric temperatures coupled with low and erratic rainfall. Soil types range from sandy or saline to heavy clayey soils. The habitat types include aquatic, sandy, gravelly ruderal habitats, forested zones, protected areas including desertic tracts as well as forests and swamps, and also agricultural fields and plantations. Such a variety of ecological factors support a mosaic of vegetation types including xerophytic plants, temperate flora (byophytes, ferns besides flowering plants) and aquatic plants.

Agriculture brings along with it the weeds of cultivation. The potential natural vegetation of Rajasthan is "northern tropical dry deciduous forest" and "tropical thorn forest" (Champion and Seth 1968).

Phytogeographical position of Rajasthan: The State falls within the Palaeotropical Kingdom (Good 1964). The desert region of western Rajasthan is included in the North African-Indian Desert region of the African subkingdom, and the rest of the region is included in the Indian region of the Indo-Malaysian subkingdom.

OBSERVATIONS

THE FLORA

According to Jain (1970), the angiospermic flora of Rajasthan comprises 1280 species belonging to 600 genera and 110 families. The present study has revealed that the flora comprises 1714 species, grouped into 728 genera and 139 families. These taxa can be categorised as under:

A comparison of the largest families in the Flora of Rajasthan with the largest families in the Flora of India (Nayar 1987) shows that Orchidaceae which is among the largest in India, is among the smallest families in Rajasthan. The same is true for the

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	Indigenous			Adventive					
				Naturalised			Cultivated		
	Dicot	Monocot	Total	Dicot	Monocot	Total	Dicot	Monocot	Total
Families	104	29	133	6	0	139	7	2	148
Genera	535	163	698	30	0	728	132	27	887
Species	1227	420	1647	58	9	1714	277	43	2034

TABLE 1
THE LARGEST FAMILIES IN THE FLORA OF RAJASTHAN

A.	**On the basis of number of species:**	
1.	POACEAE	250
2.	FABACEAE	237
3.	ASTERACEAE	125
4.	ACANTHACEAE	74
	CYPERACEAE	74
5.	EUPHORBIACEAE	56
6.	SCHROPHULARIACEAE	50
7.	CONVOLVULACEAE	48
8.	MALVACEAE	44
9.	RUBIACEAE	41
10.	LAMIACEAE	40
B.	**On the basis of number of genera:**	
1.	POACEAE	96
2.	FABACEAE	66
3.	ASTERACEAE	62
4.	ACANTHACEAE	31
5.	SCHROPHULARIACEAE	25
6.	RUBIACEAE	22
7.	ASCLEPIADACEAE	18
	EUPHORBIACEAE	18
8.	LAMIACEAE	16
9.	BRASSICACEAE	13
	CUCURBITACEAE	13
10.	MALVACEAE	12

familiy Rosaceae. Families Convolvulaceae and Malvaceae become dominant in this region.

There are 47 monogeneric families out of which 36 are monotypic.

FLORISTIC ANALYSIS

A. Endemism

According to Singh (1977), 28 taxa are endemic (considering the administrative boundaries of the State), however, 59 species are endemic to the State and regions confluent with it.

B. Floristic elements

(i) *Cosmopolitan element:* As defined by Good (1964), the cosmopolitan element comprises those species which occur throughout the temperate and tropical zones. This element forms about 2% of the naturally occurring species of Rajasthan. Some of the cosmopolitan species of Rajasthan are *Chenopodium album, C. ambrosoides, C. murale, Sonchus asper, S. oleraceus,* etc.

ii) *Pantropical element:* This element is distributed generally in the tropics, or it may be absent in any one continent (*vide* Good, loc. cit.). This category includes species which were once native in one-continent, but now they are naturalised throughout the tropical zone. This element forms 11% of the flora of Rajasthan. The pantropical element is represented in Rajasthan by *Blainvillea acmella, Cassia occidentalis, Cyperus* spp., *Digitaria ciliaris, Eclipta alba,* etc.

iii) *Boreal element:* This element occurs throughout the north temperate zone, some

TABLE 2
PHYTOGEOGRAPHICAL ANALYSIS OF NATURALLY OCCURRING TAXA

S. No.	Floristic Element	West of Aravallis	Aravallis	East of Aravallis	Rajasthan	
					No.	%
1.	Cosmopolitan	32	30	32	33	1.99
2.	Pantropical	135	136	163	183	11.04
3.	Boreal	21	14	21	33	1.99
4.	Palaeotemperate	36	26	31	40	2.41
5.	Himalayan	13	20	18	39	2.35
6.	Palaeotropical	227	237	252	310	18.71
7.	Indo-Malayan	133	184	217	273	16.47
8.	Indian	241	333	337	510	30.78
9.	African	94	53	60	110	6.64
10.	West Asian	42	35	32	46	2.78
11.	Mediterranean	41	23	36	50+2*	3.14
12.	Old World	2	3	3	4	0.24
13.	* South African	0	1	1	2	0.12
14.	* Neotropical	2	3	4	5	0.30
15.	* Burma (Myanmar)	2	1	3	6	0.36
16.	* Sri Lanka	1	0	0	1	0.06

(*Discontinuous distribution).
The phytogeographical analysis is presented only for the 1647 indigenous species. The percentages are, therefore calculated out of 1647.

of the species occur in the south temperate zone also. It forms 2% of the naturally occurring species of Rajasthan. The boreal element is exemplified by *Anaqallis arvensis*, *Galium aparine*, *Koeleria cristata*, *Ranunculus* spp. and *Stellaria media*, etc.

iv) *Palaeotemperate element:* A new term "Palaeotemperate" is suggested, which is equivalent to the zoogeographical term "Palaearctic." This element occurs in Europe, North Asia, North Africa, Central and West Asia, extending southwards to the Himalayas. This element forms 2.41% of the natural flora of Rajasthan. Some of the species of this element are *Anthemis cotula, Bunium macuca, Cirsium arvense, Epilobium hirsutum, Fumaria indica, Potentilla desertorum, Viola odorata,* etc.

v) *Himalayan element:* This element is a subdivision within the Palaeotemperate element, but considering the prominence of Himalayas in Indian biogeoraphy, this element has been treated separately. This element occurs in the Aravallis, and is also recorded from the surrounding plains in smaller numbers. It forms 2.35% of the flora of Rajasthan. The Himalayan element in Rajasthan comprises species like *Dilophia salsa, Euphorbia thomsoniana* and *Koeleria argentea,* etc.

(vi) *Palaeotropical element:* This element is distributed in the Palaeotropical kingdom (*vide* Good, loc.cit.). It also extends into North Australia and Pacific Islands. The element forms 18.71% of the indigenous flora of Rajasthan. It is represented by *Aerva lanata, Bergia ammanoides, Dentella repens, Melothria maderaspatana, Sterculia foetida, Ziziphus mauritiana,* etc. in Rajasthan.

(vii) *Indo-Malayan element:* The element occurs in Indo-Malaysian sub-kingdom (*fide* Good, loc. cit.) and extends into South China, Pacific Islands and North Australia. The general trend of increase is from west to east in Rajasthan. It amounts to 16.47% of the flora of the State.

Some of the species showing this type of distribution pattern are *Alysicarpus bupleurifolius*, *Blumea laciniata*, *Bombax ceiba*, *Caesaria elliptica*, *Crotalaria linifolia* and *Rorripa indica*, etc.

(viii) *Indian element:* This floristic element is distributed in Indian Region (*vide* Good, loc. cit.) and in different cases extends into Afghanistan, Pakistan, Sri Lanka, Himalayas, Burma (Myanmar) and South China, and sometimes into Mauritius and Mascarene Islands as well.

The Indian element forms 30.78% of the flora of Rajasthan. This element is represented by *Adhatoda beddomei*, *Anogeissus pendula*, *Dalbergia sericea*, *Moullava spicata*, *Ougenia oogeinsis*, etc.

(ix) *African element:* This western element occurs in tropical Africa and in some cases extends into South Africa. It forms 6.64% of the flora of Rajasthan. In Rajasthan this element decreases from west to east. Some of the species comprising this element are *Balanites aegyptiaca*, *Blastania fimbristipula*, *Dactyliandra welwitschii*, *Pavonia arabica*, *Sclerocarpus africanus* and *Tribulus pentandrus*, etc.

(x) *West Asian element:* The element of West Asia, also called 'Oriental' element occurs in the region Arabia to Afghanistan. This element also decreases from west to east in Rajasthan and forms 2.78% of the flora of this region. The West Asian species include *Celligonum polygonoides*, *Farsetia heliophila*, *Lycium barbarum*, *L. edgeworthii*, *Nonnea pulla* ssp. *rudbarensis*, *Prosopis cineraria* and *Tecomella undulata*, etc.

(xi) *Mediterranean element:* The Mediterranean element occurs in South Europe, North Africa and West Asia. It forms 3.14% of the flora of Rajasthan.

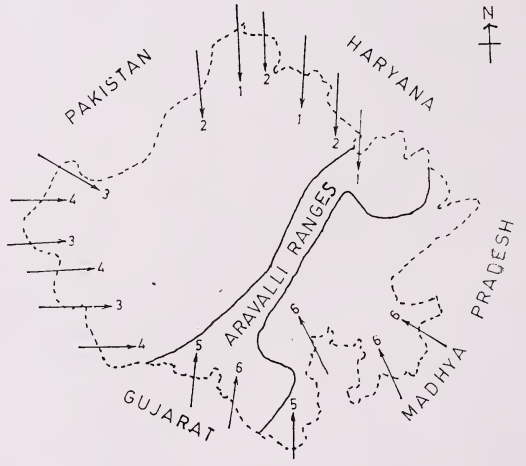
Two species of this element, namely *Fagonia cretica* and *Oligomeris linifolia* show discontinuous distribution, they occur in regions having Mediterranean climate.

(xii) *Old World element:* This element occurs in the temperate and tropical zones of the Old world only, e.g. *Najas graminea*, *N. indica*, *Polygonum plebium* and *Wahlenbergia marginata*. The Old World element amounts to 0.24% of the indigenous flora of Rajasthan.

(xiii) *Species having discontinuous distribution:* About 0.97% of the species occurring in this region have discontinuous distribution. The species which occur in disjunct areas could not be included in any floristic element with certainty, e.g. *Vernonia anceps* occurs in Rajasthan and Sri Lanka; *Millettia peguensis* and *Galactia oxyophylla* are known from Rajasthan and Burma (Myanmar) only.

The flora of the region represents 11% of the flora of the country. The richness of the flora may be attributed to the variety of niches available. Within the State, the highest floristic diversity is encountered in the Aravalli Ranges.

The State receives floristic elements from all



1. Boreal
2. Palaeaotemperate
3. West Asian
4. African
5. Indian Peninsular
6. Indo-Malayan

Fig. 1. Possible routes of migration of floristic elements into Rajasthan

the four directions — Boreal and Palaeotemperate from the north, Mediterranean, African and West Asian from the west, Indian Peninsular element from the south and Indo-Malayan element from the south and south-east (Fig. 1).

Cosmopolitan element comprises 2% of the flora, temperate element forms 10% and the remaining 88% of the flora is the tropical element.

The largest element in the flora of Rajasthan is the Indian (30.78%) followed by the Palaeotropical (18.71%) and Indo-Malayan element (16.47%). The western elements (African, West Asian and Mediterranean) are dominant over the eastern (Indo-Malayan) only in the region west of Aravallis. It is impossible, on available evidence, to accept Singh's (1977) view that the Perso-Arabian or western element predominates the Indo-Malayan element almost throughout the State. Within the Palaeotropical Kingdom, this region has greater affinity with the flora of the Indo-Malaysian subkingdom as compared to that of the African subkingdom. Though this region forms a part of the Indian biogeographical region, the flora of this region shows signs of diverging from the typical Indian flora — perhaps due to the prevailing aridity.

ACKNOWLEDGEMENT

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DICHOTOMOUS KEY TO THE TADPOLES OF TWELVE ANURAN SPECIES FROM NORTH EASTERN INDIA[1]

A.K. Sahu[2]

(With a map and twelve text-figures)

Key words: dichotomous key, anuran tadpoles, larval systematics, ontogeny, morphology

A dichotomous key to the tadpoles of *Leptobrachium hasselti* Tschudi; *Leptobrachium nigrops* Berry and Hendrickson; *Bufo melanostictus* Schneider; *Microhyla ornata* (Dum. and Bibr.); *Rana alticola* Boulenger; *Rana danieli* Pillai and Chanda; *Rana limnocharis* Weigmann; *Rana cyanophlyctis* Schneider; *Amolops afghanus* (Gunther); *Philautus cherrapunjiae* Roonwal and Kripalani; and Rhacophoridae; *Rhacophorus leucomystax* (Kuhl) and *Rhacophorus nigropalmatus* Boulenger at stages 36-38 (Gosner 1960) has been presented. The characters incorporated in the key are: oral disc, rostrodonts, keratodonts, presence or absence of oral papillae, poison gland or parotid gland, tail ocelli, ventral sucker, nostril shape, presence or absence of rim around the nostrils, presence or absence of depressions, and papillae, position of vent whether dextral or median and position of spiracle whether sinistral or median.

Introduction

Adult anurans of Indian Sub-continent are relatively well known (Boulenger 1918, 1920; Daniel 1975, Rao 1918) but studies on their tadpoles have lagged behind mainly due to the difficulty of correct identification. 40 anuran species belonging to Pelobatidae, Bufonidae, Hylidae, Microhylidae, Ranidae and Rhacophoridae have so far been reported from North Eastern India (Pillai and Chanda 1976). With increasing thrust these days on ecological, developmental and phylogenetic studies of anurans a knowledge of larval systematics has become essential.

Tadpoles form an important developmental stage in the ontogeny of anurans. Anuran tadpoles are identified by their unique distinguishing characteristics: compact head and trunk united with short vertebral column, gills and forelimbs concealed under operculum, long spirally coiled intestine and internal supporting structures of mouth and gills displaced forward and small mouth usually with elaborate external features (Orton 1953).

Amongst the earliest works, reference may be made to the description of 10 anuran species from Travancore (Ferguson 1904). Works on the tadpoles from India are brief and not based on uniform diagnostic features (Annandale 1912, Annandale and Rao 1918, Annandale and Hora 1922, Hora 1923, Kripalani 1952, Pillai and Chanda 1976, Rao 1918, Roonwal and Kripalani 1961, Swammerdam 1737, Smith 1927). Eversince the work on tadpole mouthparts, various aspects of tadpole morphology and polymorphism have been studied by different workers (see Van Dijk 1966 for review). Some of these works include detailed key to anuran larvae (Altig 1970, Van Dijk 1966, Kripalani 1952, Orton 1952, Mansukhani and Murthy 1971).

In the present paper a key to the tadpoles of 12 anuran species belonging to 5 families, namely Pelobatidae: *Leptobrachium hasselti*, Tschudi, *Leptobrachium nigrops* Berry and Hendrickson; Bufonidae: *Bufo melanostictus* Schneider; Microhylidae: *Microhyla ornata* (Dum. and Bibr.); Ranidae: *Rana alticola* Boulenger, *Rana danieli* Pillai and Chanda, *Rana limnocharis* Weigmann, *Rana cyanophlyctis* Schneider, *Amolops afghanus* (Gunther) and Rhacophoridae: *Philautus cherrapunjiae* Roonwal and Kripalani and *Rhacophorus leucomystax* (Kuhl) and *Rhacophorus nigropalmatus* Boulenger at stages 36-38 (Gosner 1960) has been presented. Further, for easy identification of the above tadpoles, a diagrammatic key is also included here. Body length was found to show considerable variations and hence not taken as a key character.

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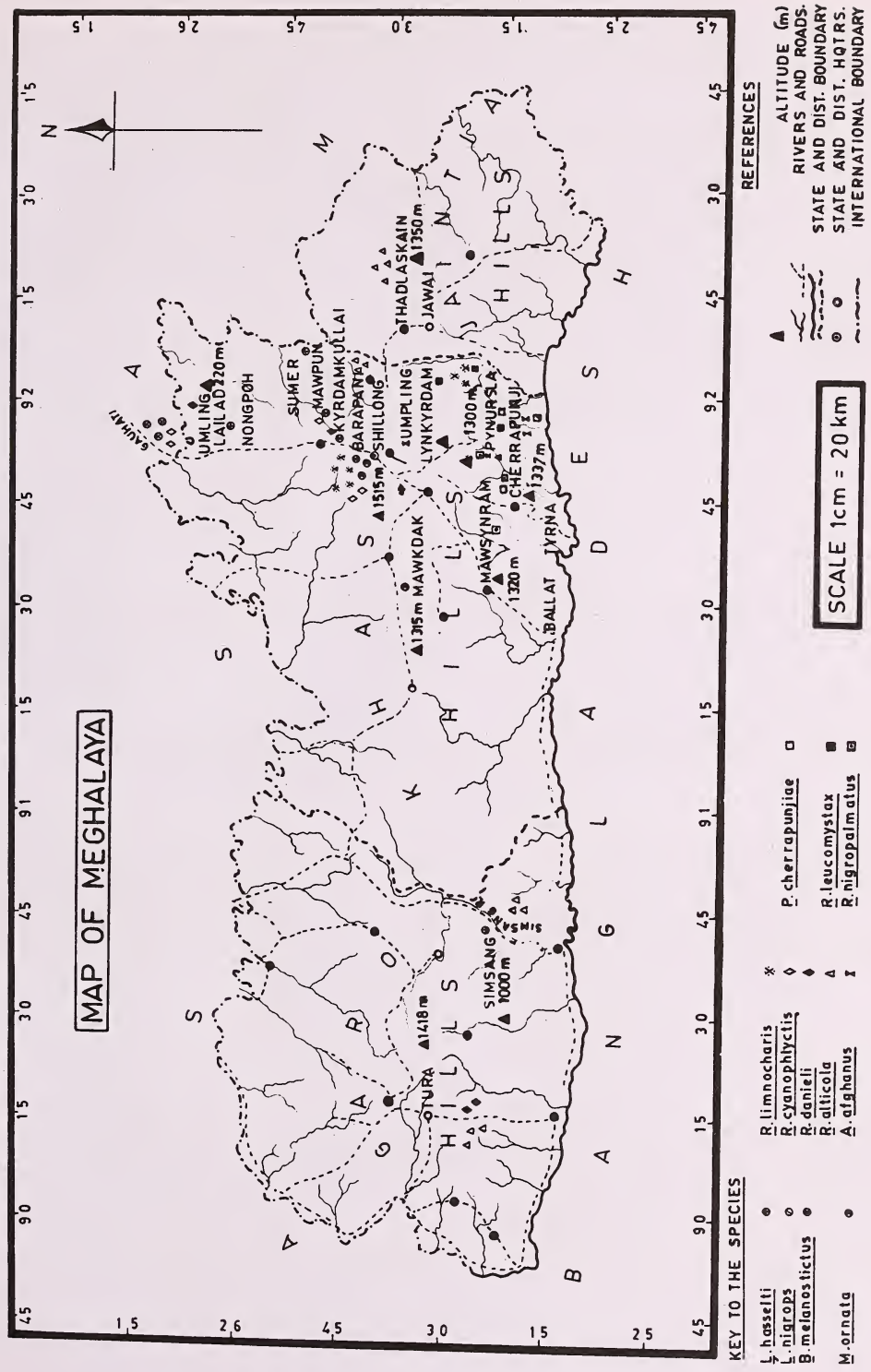
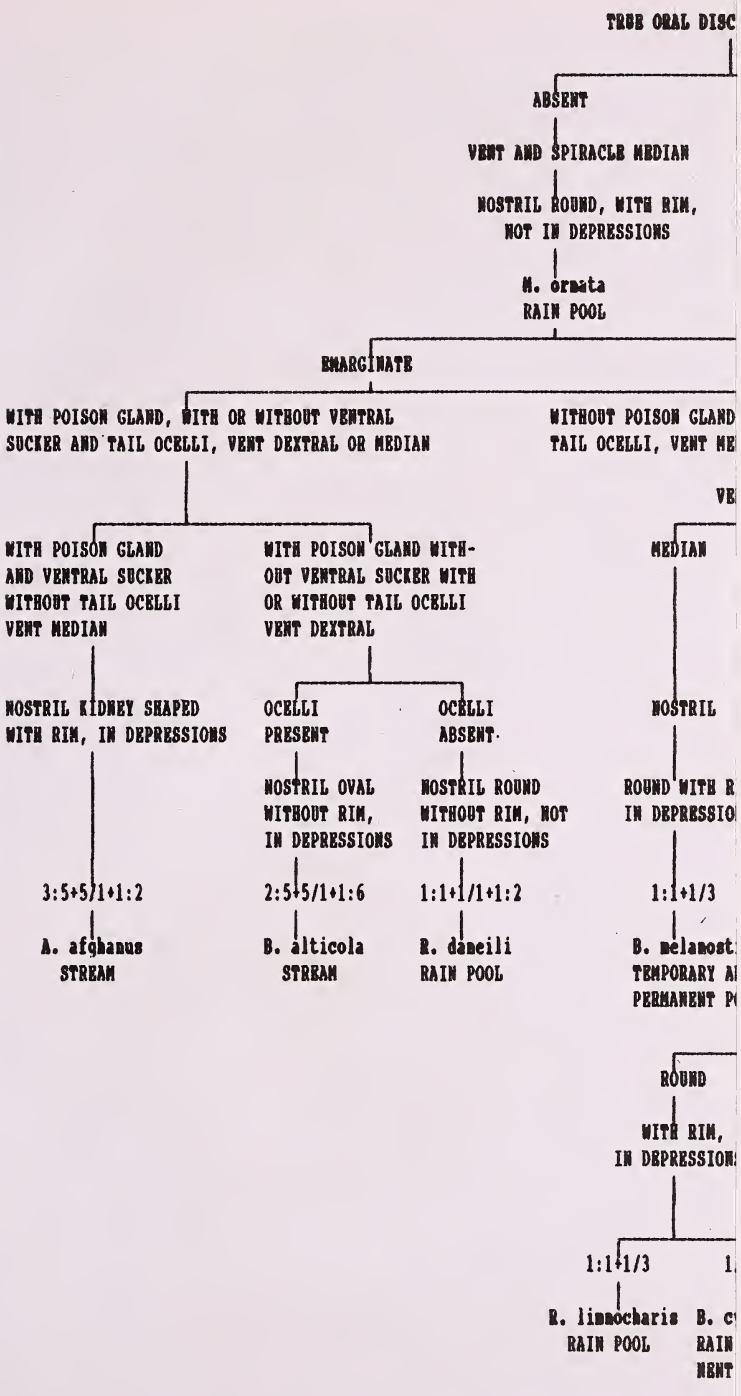


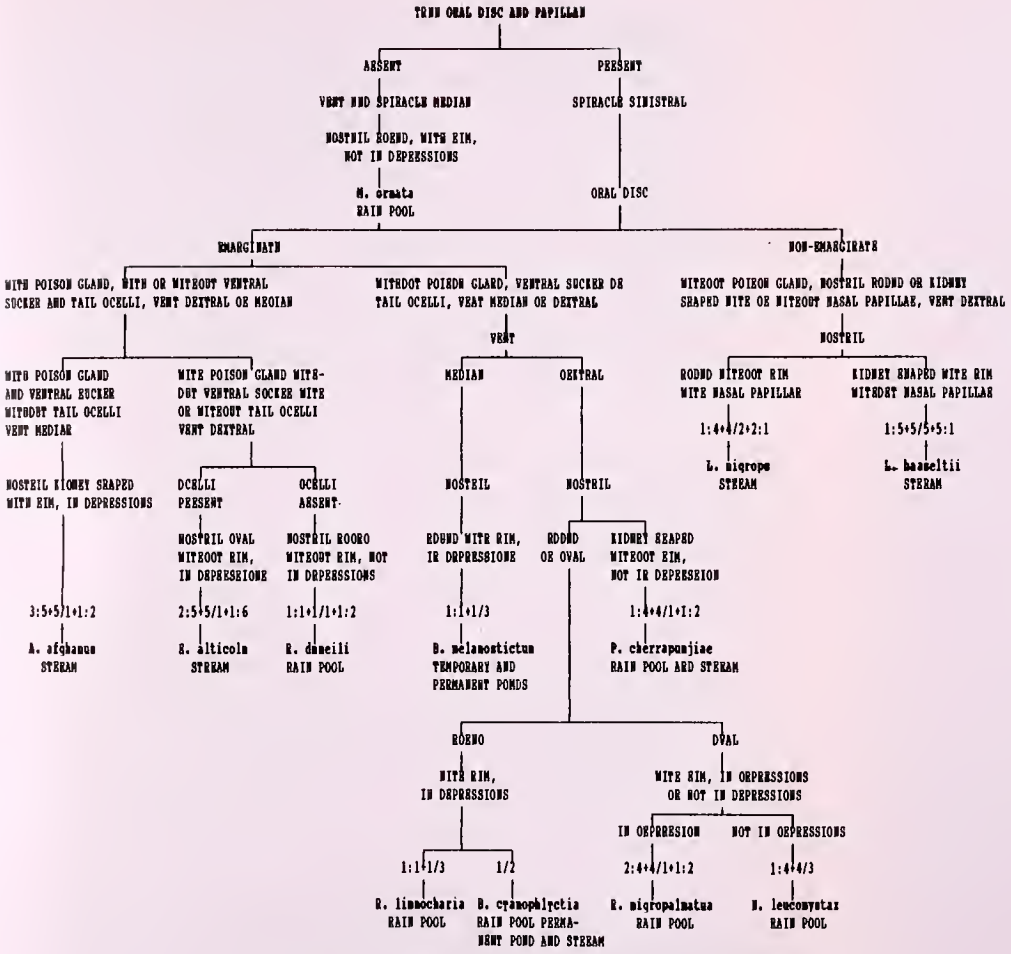
Map. 1. Map of Meghalaya : Places of collection of Anuran larvae and adults.

TABLE 1
DETAILS OF TADPOLES COLLECTION

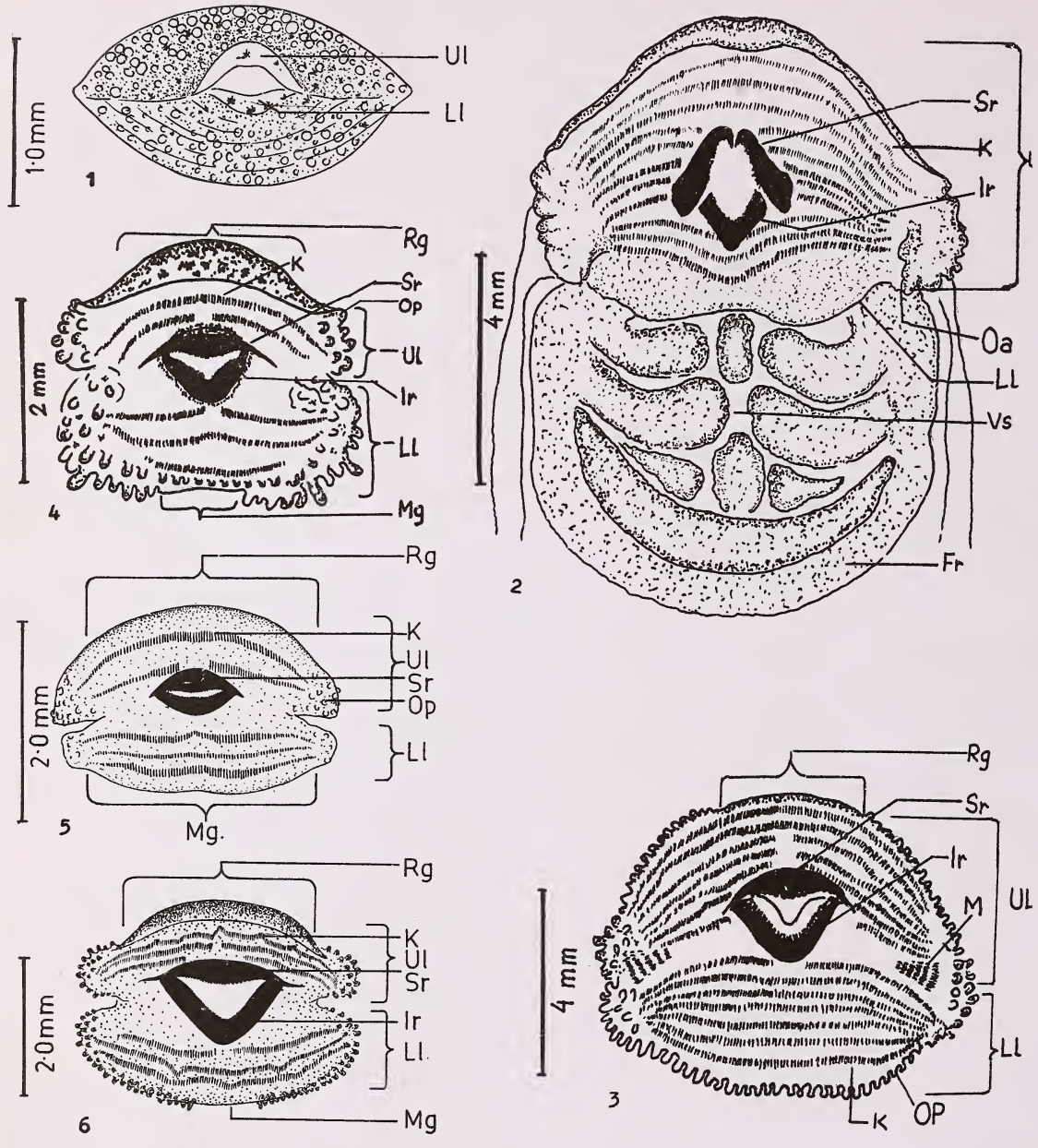
No.	Species	State	Place of collection	Type of habitats	Altitude (m) ASL	Distance (km) from Shillong
1.	*L. hasselti*	Meghalaya	**Khasi hills**			
			i) Lailad	Slow stream	296	65.00
			ii) Sumer	-do-	1200	35.00
			Garo Hills			
			i) William nagar	-do-	1000	350.00
2.	*L. nigrops*	-do-	**Khasi Hills**			
			i) Mawkdok	-do-	1225	24.00
			ii) Nonghtymmai	-do-	1520	8.00
3.	*B. melanostictus*	-do-	**Khasi Hills**			
			i) Mawpun	Pond	1225	24.00
			ii) Nongthymmai	Pond	1520	8.00
4.	*R. alticola*	-do-	**Khasi Hills**			
			i) Barapani	Stream	1250	20.00
			Jaintia Hills			
			i) Thadlaskein	Pond (permanent)	1340	40.00
			ii) Jowai	-do-	1350	55.00
			Garo Hills			
			i) William nagar	Stream	1000	350.00
5.	*R. danieli*	-do-	**Khasi Hills**			
			i) Umling	Swamp	290	65.00
			ii) Kyrdemkulai	Stream	1200	30.00
			Garo Hills			
			i) Tasek	Stream	1400	323.00
6.	*R. limnocharis*	Meghalaya	**Khasi Hills**			
			i) Golf link	Temporary pond	1515	6.00
			ii) Pologround	-do-	1515	5.00
			iii) Nongthymmai	-do-	1515	8.00
			iv) Pynursla	-do-	1350	75.00
7.	*R. cyanophlyctis*	-do-	**Khasi Hills**			
			i) Golf link	-do-	1515	6.00
			ii) Pologround	-do-	1515	5.00
8.	*A. afghanus*	-do-	**Khasi Hills**			
			i) Umling	Rapid stream	1515	1.5
			ii) Cherapunji	-do-	1337	45.00
			iii) Pynursla	-do-	1350	75.00
9.	*P. cherrapunjiae*	-do-	**Khasi Hills**			
			i) Pynursla	Slow stream	1350	75.00
			ii) Cherrapunji	-do-	1337	45.00
10.	*R. leucomystax*	-do-	**Khasi Hills**			
			i) Lynngkyrdam	Temporary pond	1350	58.00
11.	*R. nigropalmatus*	-do-	**Khasi Hills**			
			i) Mawsynram	-do-	1305	45.00
			ii) Cherrapunji	-do-	1337	45.00
12.	*M. ornata*	Assam	Barpeta	Temporary pond	50	200.00



FIELD KEY TO THE 12 TADPOLES INV

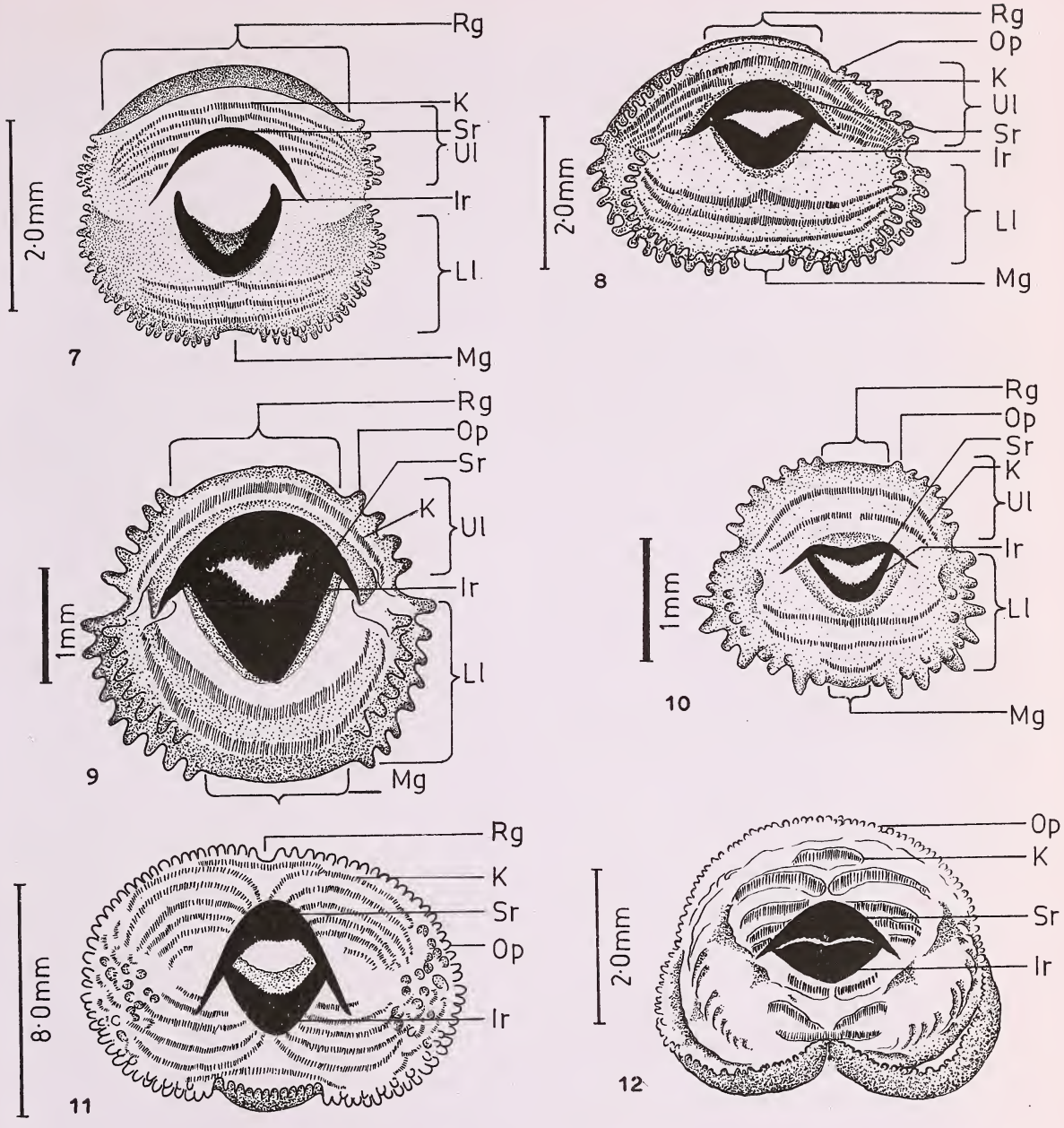


FIELD KEY TO THE 12 TADPOLES INVESTIGATED FROM N.E. HILLS OF INDIA



Figs. 1-6. Oral discs of tadpoles: 1. *Microphyla ornata* (Dum. & Bibr.); 2. *Amolops afghanus* (Gunther); 3. *Rana alticola* Boulenger; 4. *Rana danieli* Pillai & Chanda; 5. *Bufo melanostictus* Schneider; 6. *Philautus cherrapunjiae* Roonwal & Kripalani.

Abbreviations: Fr - Free rim of the ventral sucker; Ir - Infra-rostrodont; K - Keratodont row; Ll - Lower labium; M - Marginal tee Mg - Mental gap; Oa - Oral angle; Op - Oral papillae; Rg - Rostral gap; Sr - Supra-rostrodont; Ul - Upper labium; Vs - Ventral sucker.



Figs. 7-12. Oral discs of tadpoles: 7. *Rhacophorus nigropalmatus* Boulenger; 8. *Rhacophorus leucomystax* (Kuhl); 9. *Rana cyanophlyctis* Schneider; 10. *Rana limnocharis* Weigmann; 11. *Leptobrachium hasselti* Tschudi; 12. *Leptobrachium nigrops* Berry & Hendrickson.

Abbreviations: Ir - Infra-rostrodont; K - Keratodont row; Ll - Lower labium; Mg - Mental gap; Op - Oral papillae; Rg - Rostral gap; Sr - Supra-rostrodont; Ul - Upper labium.

Materials and Method

The tadpoles of different species of frogs and toads for the present study were collected from different parts of Meghalaya (Map 1), Assam and Nagaland as detailed below (Table 1).

These tadpoles were reared in the laboratory in glass aquaria filled with pond water up to a height of approximately 15.00 cm set with a steep sand base on one side and some stones on the other to provide an amphibious environment. Some tadpoles (stages 36 - 38) were fixed in 6% formaldehyde solution and the rest allowed to metamorphose to froglet stage for identification of the species. Key character were studied under a dissecting binocular microscope as per the criteria of Van Dijk (1966).

Dichotomous Key

True oral disc with rostrodonts, keratodonts and oral papillae present. Poison or parotid gland, tail ocelli and ventral sucker present or absent. Nostril round, oval or kidney shaped with or without rim and in depression or not in depression, with or without nasal papillae 1

True oral disc with rostrodonts, keratodonts and oral papillae absent. Poison or parotid glands, tail ocelli and ventral sucker absent. Nostrils round with rim and not in depression, without nasal papillae 2

1. Spiracle sinistral, vent median or dextral 3

2. Spiracle and vent median ..... *Microhyla ornata* (Fig. 1)

3. a) Oral disc emarginate, with 1-8 supra and 2-7 infraangular keratodont rows. Vent median or dextral. Nostrils without nasal papillae. Poison or parotid glands, tail ocelli and ventral sucker present or absent 4

3. b) Oral disc nonemarginate with 5-6 supraangular and 3-6 infraangular keratodont rows. Vent dextral. Nostrils with or without nasal papillae. Poison or parotid glands, tail ocelli and ventral sucker absent 10

4. a) Nostrils without nasal papillae. Poison or parotid gland present, ventral sucker and tail ocelli present or absent 5

4. b) Nostrils without nasal papillae, Ventral sucker and tail ocelli absent 5

5. a) Oral disc with 8 supra - (5 interrupted) and 3 infraangular (1 interrupted) keratodont rows, vent median, nostrils kidney shaped with rim and in depression. Ventral sucker present but tail ocelli absent ..... *Amolops afghanus* (Fig. 2)

5. b) Oral disc with 2-7 supra - and 2-7 infraangular keratodont rows. Vent dextral. Nostrils round or oval without rim and in depression or not in depression. Ventral sucker absent and tail ocelli present or absent 6

6. a) Oral disc with 7 supra - (5 interrupted) and 7 infraangular (1 interrupted) keratodont rows. Nostrils oval and in depressions. Tail ocelli present ..... *Rana alticola* (Fig. 3)

6. b) Oral disc with 7 supra- (5 interrupted) and 7 infraangular (1-interrupted) keratodont rows. Nostrils oval and in depression. Tail ocelli absent ..... *Rana danieli* (Fig. 4)

7. a) Vent median. Nostrils round or kidney shaped with or without rim and in depression or not in depression 8

7. b) Vent dextral. Nostrils round, oval or kidney shaped with or without rim and in depression or not in depression 9

8. a) Oral disc with 2 supra (1 interrupted) and 3 infra angular (uninterrupted) keratodont rows. Nostrils round in depression ..... *Bufo melanostictus* (Fig. 5)

9. a) Oral disc with 1-6 supra - and 2-3 infraangular keratodont rows. Nostrils round or oval with or without rim and in depressions or not in depressions 10

9. b) Oral disc with 5 supra - (4 interrupted) and 3 infraangular (1 interrupted) keratodont rows. Nostrils kidney shaped, without rim and not in depressions ..... *Philautus cherrapunjiae* (Fig. 6)

10. a) Nostrils round with or without rim and in depression or not in depression 11

10. b) Nostrils oval with rim and in depressions or not depressions 12

11. Oral disc with 1-2 supra and 2-3 infraangular keratodont rows. Nostrils with rim and in depressions 13

12. a) Oral disc with 6 supra - (4 interrupted) and 3 infraangular (1 interrupted) keratodont rows. Nostrils with rim and in depressions ..... *Rhacophorus nigropalmatus* (Fig. 7)

12. b) Oral disc with 5 supra - (4 interrupted) and 3 infraangular (1 interrupted) keratodont rows. Nostrils with rim and not in depressions ..... *Rhacophorus leucomystax* (Fig. 8)

13. a) Oral disc with 1 supra - (uninterrupted) and 2 infraangular (1 interrupted) keratodont rows ..... *Rana cyanophlyctis* (Fig. 9)

13. b) Oral disc with 2 supra - (1 interrupted) and 3 infraangular (1 interrupted) keratodont rows ..... *Rana limnocharis* (Fig. 10)

14. Oral disc with 6 supra - (5 interrupted) and 6 infraangular (5 interrupted) keratodont rows. Nostrils kidney shaped, with rim but without nasal papillae and in depressions ..... *Leptobrachium hasselti* (Fig. 11)

15. Oral disc with 5 supra - (1 interrupted) and 3 infraangular (2 interrupted) keratodont rows. Nostrils round without rim, with nasal papillae and not in depressions ..... *Leptobrachium nigrops* (Fig. 12)

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POLYCHAETES OF THE GENUS *MANAYUNKIA* LEIDY (POLYCHAETA:SABELLIDAE) FROM EAST COAST OF INDIA (BAY OF BENGAL)[1]

A.L.N. Sarma[2], K.R. Raju[3] and V. Wilsanand[2]

(With eleven text-figures)

Key words: polychaeta, Sabellidae, *Manayunkia*, zoogeography, migration, budding

The present communication redescribes *Manayunkia spongicola* and gives a synopsis of four undetermined species of *Manayunkia*, inhabiting flocculent soft detritus-laden coral skeletons of *Tubastraea aurea* off the Orissa coast, at a depth of 12 metres. Indication of reproduction by budding is reported. Zoogeography of the known species of *Manayunkia* and their probable migration from marine to brackish and fresh waters are discussed. The impact of aphytal biota on the distribution of benthic faunal communities is also discussed. The possible utility of *Manayunkia* in aquacultural practices is indicated.

Introduction

The genus *Manayunkia* consists of tubicolous micro-annelid sabellids, essentially known from fresh water environs like rivers, lakes of North America (Leidy 1883, Foster 1972, Holmquist 1973, Poe and Stefan 1974, Spencer 1976) and estuarine and coastal brackish waters of Western Europe (Muus 1967, Green 1968, Remane 1971, Barnes 1976). *Manayunkia* is also known from the Congo River, West Africa; Brasilian mangroves; Danube River and North Japan Sea (*vide* Hartman 1959).

From Indian Waters, so far only a single species, *M. spongicola* inhabiting tubes embedded in the sponge *Laxosuberites lacustris* and among the algae under rocks in the littoral region of Chilka lagoon was described by Southern (1921). A perusal of the published literature reveals no subsequent reporting of *Manayunkia* from the Indian aquatic (marine, brackish, fresh water) systems excepting for its being listed among the phytal fauna of Chilka lagoon by Satapathy (1985). In the present systematic studies, a large number of specimens of *Manayunkia* have been recovered from the meiofauna of the coral skeletal washings of *Tubastraea aurea* laden with fine flocculent mud at a depth of 12 metres off the coast of Gopalpur, Orissa (19° 14' to 20° 2' N; 84° 51' to 85° 2' E). They were found inhabiting delicate membranous tubes covered with flocculent mud. The specimens appear to represent a species complex of the genus and do not belong to a single species. However, a good number of specimens excellently confirmed with *M. spongicola* described from Chilka lagoon seven decades ago (Southern 1921). In view of the characters, namely the nature of the branchiae, cephalic eye spots, segmental length and the presence or absence of caudal eyes (often one or two characters only), considered for the specific determination by the earlier taxonomists, the specimens could not be satisfactorily identified with any of the known species of the genus, and could be new to science. However, since intraspecific variation (within and amongst the characters) of the members of the genus are not known, new description and erection of new species is not resorted to as identifications based on a single or two characters would invariably lead to abandonment of the species sooner or later. Further, Mayer (1971) stated "Intraspecific morphs are often far more different from each other than sibling species" (p. 81).

As such, a brief description of the rediscovered *M. spongicola* with remarks on the present finds is presented here alongwith a synopsis of the observed characters of the undetermined species at hand. The systematic and ecological importance of *Manayunkia* is also discussed.

Material and Methods

Aphytal communities of sponges (*Petprosia testudinaria, Aurora globostellata, Fasciospongia*

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cavernosa, Spongia officinalis, Phakellia dendyi), skeletons of corals (*Cladangia exusta, Cyathelia auxillaris, Dendrophyllia arbuscula, Tubastraea aurea*) and gorgonians (*Echinogorgia complexa, E. reticulata, Gorgonella umbraculum, G. sanguinolenta, Muricella complanata*) were collected from a depth of 12 metres off the coast of Gopalpur, Orissa, employing SCUBA diving. The different aphytal colonies brought on to the board of the vessel were transferred separately to large polythene containers with 4% formalin solution and brought to the laboratory. The contents of each of the polythene containers were poured into separate polythene tubs and thoroughly washed in 4% formalin solution to dislodge the epifauna. Later, the coral skeletons and sponges were broken into small pieces and placed in petri dishes and thoroughly searched for the epibionts and endobionts under stereoscopic binocular microscope. Each of the residues left in the polythene tubs was sieved separately with 500 μ and 60 μ sieves. The residue left on the 500 μ sieve was considered for macrofauna and that on 60 μ sieve for meiofaunal studies.

Results

SYSTEMATICS

Genus **Manayunkia** Leidy, 1859

Haplobranchus Bourne, 1883; *Dybowscella* Nusbaum, 1901; *Garjaiewella* Dybowski, 1929. (*vide* Hartman 1959).

Cylindrical body; unbranched symmetrical branchial lobes; no branchial radioles with cartilagenous axis and lateral pinnules; two short clavate processes, 'the palps' or prostomial tentacles within the circle of the branchiae; a well developed entire collar; with or without the caudal eyes; dorsal thoracic setae; uncini with a long stalk; pick-axe shaped setae absent; abdominal uncini elongated and ventral capillary setae.

Type species: *Manayunkia speciosa* Leidy, 1859.

Manayunkia spongicola Southern, 1921 (Figs. 1-5)

Locality: Numerous specimens associated with the coral. *Tubastraea aurea* off the Gopalpur coast at a depth of 12 metres.

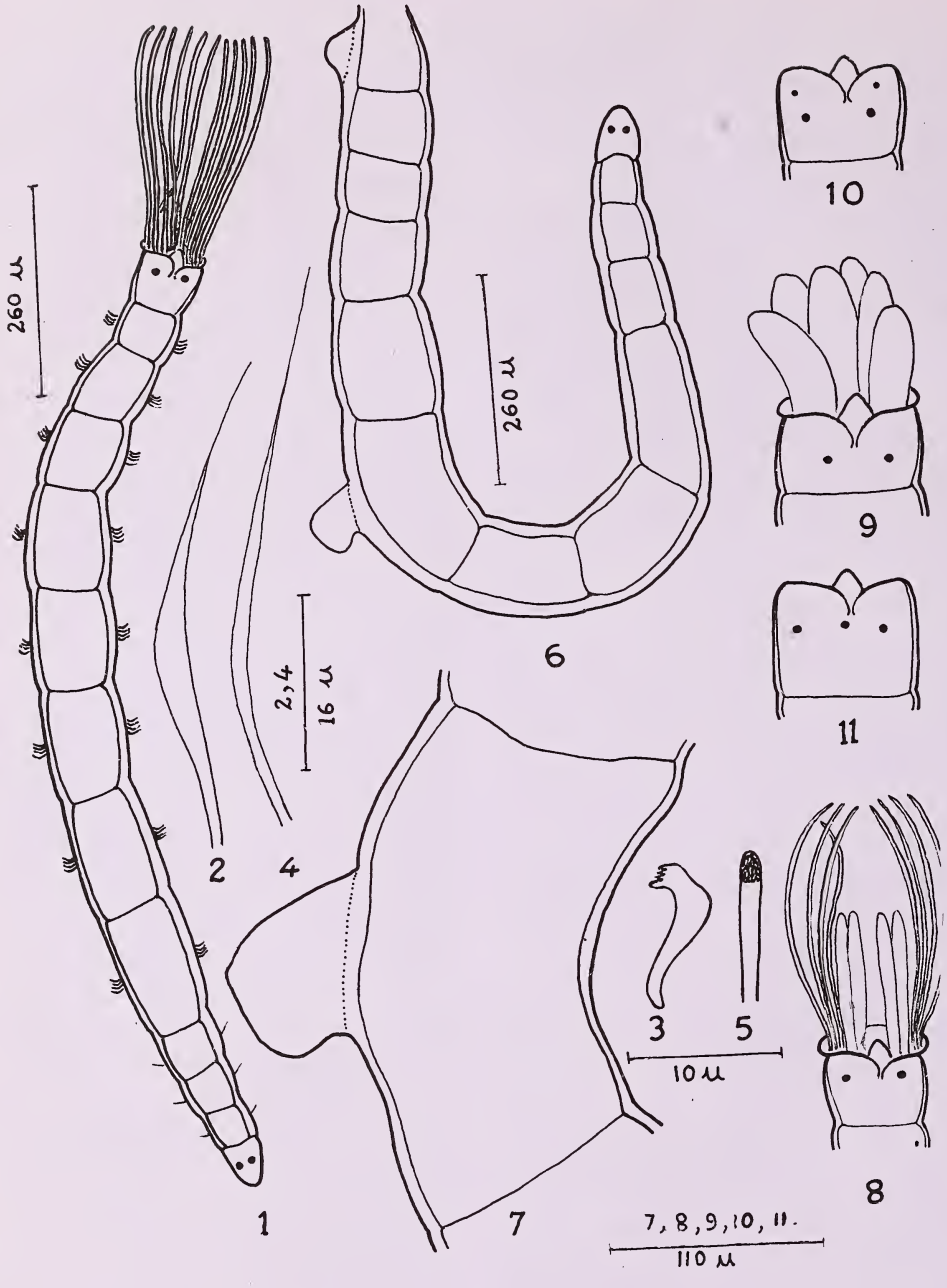
Material: In our collection in the Department of Life Sciences, Regional College of Education, Bhubaneswar.

Description: The specimens varied in length from 0.4 mm to 2 mm; branchial region measured 0.06 mm to 0.6 mm; thoracic region 0.27 mm to 1.6 mm and abdomen 0.09 to 0.25 mm. Body cylindrical. Head conical infront bearing 2 black eyes. Two short clavate palps or prostomial tentacles. A prominent well developed collar which is entire and convex ventrally. No otocysts. Thorax consists of 8 segments. The first three segments behind the collar are short and the succeeding segments gradually increase up to 8th segment, which is the largest of the body. Thoracic segments bear capillary setae with short flattened blade and long slender tips (Fig. 2). Ventral hooks stout with 3 teeth above the main fang (Fig. 3). Three abdominal neuro setae with 1-2 capillary setae (Fig. 4). Notopodia 9-11 hooks with numerous long fine teeth (Fig. 5) in several rows at one end. First and last segments of the body devoid of setae; pygidium spatulate or pear-shaped bearing 2 black eye spots. Tube membranous covered with flocculent mud. Circulatory system is well developed and whole body is coloured by the bright green chlorocruorin of the blood.

Distribution: Chilka lake; Gopalpur coast (Bay of Bengal), India.

Remarks: A large sized lateral swelling on the 5th trunk segment was noted (Figs. 6,7). This appears to be an indication that these polychaetes also reproduce by budding. Leidy (1883) observed in *M. speciosa* that the development is direct and a free swimming trochophore larva is absent. Pennak (1978) commented on the large size and lateral swellings of the 6th trunk segment of *M. speciosa* as an indication of reproduction by budding.

A brief synospsis of the distinct characters of the undetermined species is given below.



Figs. 1-11. *Manayunkia spongicola* Southern

1. Entire animal, dorsal view; 2. Thoracic capillary setae; 3. Thoracic crochet; 4. Abdominal capillary setae; 5. Abdominal crochet; 6. *M. spongicola* showing bud on 5th trunk segment and everted proboscis on cephalic region; 7. Enlarged view of 5th segment showing bud; 8. *M.* sp. showing long and short tentacles; 9. *M.* sp. showing short and blunt tentacles; 10. *M.* sp. showing 4 eye-spots on cephalic region; 11. *M.* sp. showing 3 eye-spots on cephalic region.

Manayunkia sp. 1: Typically characterised by simple, unbranched branchiae of two kinds, namely 1) short and blunt (club shaped); 2) long and slender (Fig. 8). The morphological details of head, collar, thoracic and abdominal setae and uncini and pygidium are similar to those of *M. spongicola.*

Manayunkia sp. 2: Presence of six simple, unbranched short and blunt (digitiform) branchiae is the distinguishing feature (Fig. 9). Body comprised of 13 thoracic and 3 abdominal setigerous segments. Seventh, eighth and ninth thoracic segments relatively larger than the rest of the segments. The nature of shape, size and arrangement of the thoracic and abdominal setae and uncini as in *M. spongicola.*

Manayunkia sp. 3: Characterised by 4 eye-spots on the cephalic region (Fig. 10) and 2 eye-spots on the pygidium. The morphological features of general body including head, collar, branchiae, thorax, abdomen and pygidium are similar to those of *M. spongicola.*

Manayunkia sp. 4: The distinguishing character is the presence of 3 eye-spots on the head (Fig. 11) and 2 eye-spots on the pygidium while the rest of the body morphology conforms with those of *M. spongicola.*

Discussion

Taxonomically the genera *Manayunkia* and *Fabricia* present interdigitating characters. Both the genera share the following characters: 1. The body consists of 11 setigerous segments, of which 8 are thoracic and 3 abdominal. 2. The dorsal and ventral setae on the thoracic segments are similar in shape. 3. Elongate crochets in the abdominal segments. 4. The first segment bears eyes. 5. Otocysts absent. However, *Manayunkia* differs from *Fabricia* in having a well developed collar and simple, unbranched branchiae. The genus is a rare exception among sabellids in the sense the branchial radioles are devoid of a cartilaginous axis and lateral pinnules (Day 1967). Zoogeographically, the genus appears to be well speciated and distributed in the temperate, warm temperate latitudes than in the tropical and subtropical latitudes (Table 1). *M. speciosa, M. eriensis* from the American river systems; *M. aestuarina*; *M. caspia*; *M. baltica*; *M. baicalensis* from the fresh water, coastal lagoon and estuarine locales of Europe; *M. pacifica* from Bering sea and Western Canada; *M. polaris* from North Western Russia; *M. siaukhu* from North Japan Sea; *M. africana* from Congo River; *M. brasiliensis* from mangroves of Brazil and *M. spongicola* from Chilka lagoon of India are known.

The apparent low speciation of *Manayunkia* in tropics and subtropics in general, and the Indian Ocean in particular, reflects lack of intensive faunistic searches for these interesting micro-sabellids in these locales.

Ecologically the genus is eurytopic and one of the very few euryhaline polychaete members which presumably have surmounted the physiological adjustments necessary for the marine - brackish-fresh water transition.

Green (1968) opined, considering the ability of *M. aestuarina* to tolerate low salinities (2‰), that the genus might have probably penetrated into fresh water with its representatives like *M. speciosa* known from several rivers of Philadelphia and from Great Lakes. While discussing the probability of marine origin of *Manayunkia,* it is worth quoting Remane (1971, p. 148) who stated that "High percentage of the pontocaspian relicts of marine origin have succeeded in invading fresh water, at least the lower reaches of the river, e.g. the polychaetes *Hypania invalida, Manayunkia caspia".* Lagoonal biotopes/substrates rich in detritus are stated to be congenial for the densities of *M. aestuarina* (Remane 1971, p. 165). The euryoecious nature of *Manayunkia* and the abundance of *M. aestuarina* up to 20,000 individuals per square metre was reported by Muus (1967) in his studies on the lagoons of Denmark. Of late, the occurrence of *Manayunkia* from soft detritus in a fully marine condition is also known (Barnes 1976, p. 18). The present finding from typical marine location further validates the euryoecious nature of *Manayunkia.*

In view of the predominantly soft detritus rich biotopes or substrata inhabitation of *Manayunkia*

TABLE 1
ZOOGEOGRAPHICAL DISTRIBUTION OF SPECIES OF *MANAYUNKIA*

Name of species	Locality	Author
Manayunkia aestuarina	Thames Estuary, England; estuaries of Western Europe; lagoons of Denmark.	Bourne (1883); Green (1968); Muss (1967).
M. africana	River Congo, Africa.	Monro (1939) (*vide* Hartman, 1959).
M. baicalensis	Lake Baikal; river systems of Siberia.	Nusbaum (1901) (*vide* Hartman, 1959), Green (1968).
M. baicalensis hydani	Lake Baikal.	Slastnikov (1942) (*vide* Hartman, 1959).
M. baltica	Baltic Sea.	Karling (1933) (*vide* Hartman, 1959).
M. brasiliensis	Estuarine mangroves, Brazil.	Banse (1956)
M. caspia	Caspian Sea; Black Seas.	Annenkova (1928) (*vide*, Hartman, 1959), Green (1968).
M. caspia fluviatilis	Danube River, Romania.	Bacesco (1949) (*vide* Hartman, 1959).
M. eriensis	Lake Erie, Ohio.	Krecker (1939) (*vide* Pennak, 1978).
M. pacifica	Bering Sea.	Annenkova (1934) (*vide* Hartman, 1959).
M. polaris	Bering Sea, Murman coast, Russia.	Zenkevitch (1935) (*vide* Hartman, 1959).
M. siaukhu	North Japan Sea.	Annenkova (1938) (*vide* Hartman, 1959).
M. speciosa	Schuylkill River, Philadelphia; South eastern Pennsylvania; New Jersey; Great Lakes; Alaska; Cayuga Lake, New York; California; Carolina; Georgia.	Leidy (1859); Pennak (1978); Holmquist (1973); Spencer (1976).
M. spongicola	Chilka Lake, India (embedded in sponge Laxosuberites and among algae under rocks).	Southern (1921).
	Gopalpúr, Orissa Coast (Bay of Bengal), at a depth of 12 metres.	Present authors.
M. sp. 1	Gopalpur, Orissa Coast (Bay of Bengal), at a depth of 12 metres.	Present authors.
M. sp. 2	Gopalpur, Orissa Coast (Bay of Bengal), at a depth of 12 metres.	Present authors.
M. sp. 3	Gopalpur, Orissa Coast (Bay of Bengal), at a depth of 12 metres.	Present authors.
M. sp. 4	Gopalpur, Orissa Coast (Bay of Bengal), at a depth of 12 metres.	Present authors.

in various American rivers and lakes; brackish and estuarine environs of Western Europe as indicated above, the occurrence of *M. spongicola* among the sponge *Laxosuberites lacustris* and among the algae under rocks from Chilka Lake and coral skeletons in the present study is attributed to the presence of rich soft detritus deposition on the aphytal systems.

Further, the physiognomy of the non-sedimentary biota like phytal (algal thickets) and aphytal (sessile animal growth of sponges, corals, bryozoans, gorgonians etc.) besides the quality and quantity of sediment deposited on them were reported dictating patterns of distribution and abundance of organismic communities among the benthic biota (Dahl 1948, Wieser 1952, 1959; Hagerman 1966, Sarma 1972, 1974a, 1974b, 1974c; Sarma and Ganapati 1972, 1975; Sarma and Gopalswamy 1975, Sarma and Satapathy 1978, Sarma *et al.* 1979, 1981).

By implication, the eurytopic and the euryoecious nature of the species of *Manayunkia* should render them as effective tools not only to enquire into the nature of adaptational physiology but also to conduct bio-assay studies with reference to aquatic pollutants. Their mass cultivation in laboratory conditions could also be resorted to produce protein-rich viable feed for fin fish and shell fishes in aquacultural practices. The known direct development strategy of reproduction adopted by *Manayunkia* without a free swimming trochophore larva, besides its probable ability to reproduce asexually by budding, should further enhance the potential of this micro-annelid for mass cultivation to be used as fish food. Studies aimed at determining its nutritive value would probably go a long way to render it an efficient and economic feed for cultivable prawns and fishes.

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A FALL LAND BIRD MIGRATION ACROSS THE SOUTH CHINA SEA FROM INDO-CHINA TO THE GREATER SUNDA ISLANDS[1]

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(With two text-figures)

Key words: landbirds, migration, corridor, south China sea

We encountered 150 land birds representing 14 families along the cruise track of the Soviet Oceanographic Research Vessel *AKADEMIK KOROLEV* in the South China Sea. We saw most of these birds during a 3-day period in a small area *c.* 350 km southeast of the southern tip of the Indo-China Peninsula. These observations suggest that a significant land bird migration corridor crosses the South China Sea from Viet Nam to Borneo.

INTRODUCTION

Until 1960, migration corridors for eastern Asia were poorly known (Wetmore 1926, Delacour 1947, McClure 1974, Medway and Wells 1976), but important flights have recently been discovered: one extends south from Japan and eastern China through the Philippine Islands, and another corridor passes down the Malay Peninsula (McClure 1974, Medway and Wells 1976). A less important passerine migration pathway crosses the Gulf of Thailand from Indo-China to the Malay Peninsula (McClure 1974).

Evidence for a land bird migration corridor across the South China Sea is very limited. Biologists from the Chinese Academy of Science and the Beijing Natural History Museum (Anon. 1974) noted 44 species of land birds during 1974 surveys of the islets in the northern two-thirds of the South China Sea (outside our study area). More recently, Simpson (1983a; b) encountered hundreds of migrant land birds at the Tembungo offshore oil drilling platform near the northeastern tip of Borneo during the fall migration of 1981. Although Simpson reported his observations as evidence of a passage directly over the South China Sea, his location near Balabac Strait suggests that the migrants he observed were likely moving south and west from the Philippines. Further, McClure (1974) asserts that many migrants passing through the Philippines enroute to Borneo fly west from Palawan then south to Borneo. More recently, Simpson (Wells pers. comm. and 1990) reported a substantial fall movement of land birds (36 species) in the Terengganu oil field (*c.* 05°25' N, 105°13'E, see Fig. 1). Although this location is only *c.* 200 km east of the Malay Peninsula, Simpson's records provide the best evidence to date of a direct South China Sea crossing for migrant land birds.

The geography of the land masses surrounding the South China Sea seem to create three natural funnels that should concentrate migrant land birds into three primary corridors. First, migrants moving south from Burma and western Thailand should flow onto the Malay Peninsula. Second, many of those in eastern China could island-hop south through the Philippines, and third, those moving south into Indo-China would naturally converge south of the Mekong River delta on Mui Bai Bung cape. From the Indo-China Peninsula, birds travelling overland must fly north and west into Thailand before proceeding south, while those capable of a relatively short oversea migration can fly southwest toward the Malay Peninsula. Those adapted for long over-water passage could fly south toward the distant land masses of Borneo and the other Greater Sunda Islands.

The first two routes (i.e. down the Malay Peninsula and island-hopping through the Philippines) are known to be important corridors for fall migrants (Wetmore 1926, McClure 1974, Ng 1978). In addition, McClure (1974) and Hails (1987) portray a minor pathway for land birds extending from Indo-China across the Gulf of Thailand to the Malay Peninsula. McClure (1974) also mentions a fall passage of Willow Warblers (*Phylloscopus* sp.) across the South China Sea to

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Sarawak (Borneo) without offering details on their point of origin north of the sea. Further, Ng (1978) presents evidence for a Barn Swallow *(Hirundo rustica)* migration from mainland China to the Philippines. Finally, McClure (1968 *in* McClure 1974) illustrated a coastal migration route from Taiwan to northern Viet Nam, thence south crossing the South China Sea to Borneo. However, none of these authors report the pooling of migrants on the tip of Indo-China or at any other point of departure north of the South China Sea. The only published suggestion of such a migration corridor is Simpson's (1983a) observations of sizable movements of land birds near the northeastern tip of Borneo, not far southwest of Palawan. This location, however, lies on a migration route already recognized by McClure (1974) as important in the passage of birds, not across the South China Sea to Borneo, but through the Philippines to Borneo.

Study Area and Methods

In this report, we present observations of migrant land birds encountered during our 23-31 October 1988 indirect passage (Fig. 1) from Balabac Strait to Singapore on the Soviet Research Vessel AKADEMIK KOROLEV (Ellis *et al.* 1992). While in transit, we observed birds during dawn-to-dusk seabird surveys from the flying bridge (12 m above sea level). During a 3-day period while the ship was anchored or drifting without power (Fig. 1, station 13; 06° 01' N, 106° 55' E), we conducted periodic walking inspections of the ship (usually at half-hour intervals) and searched the ship each night by torch to count roosting birds. Five raptors and several Barn Swallows were captured by hand (primarily during these nightly tours) and examined for physical condition.

Results And Discussion

During our 9-day passage, we encountered *c.* 150 land birds (121 by conservative count, 84 minimum count; Table 1) representing 14 Families. Almost all were migrants that winter (at least in part) south of the South China Sea. Most of these birds (104 by conservative count) arrived on the ship during the 3-day period while we were stationary (Fig. 1, station 13) *c.* 350 km southeast of the southern tip of Indo-China. The presence of land birds at this location suggests that these birds were in passage across the South China Sea from Indo-China to the Greater Sunda Islands. The low bird counts seen before arriving at and after leaving this location (Table 2) strongly suggests that this spot lies on a rather narrow migratory corridor. Alternately, birds may be reluctant to approach a moving vessel. Simpson's (Wells 1990) 1982 observations, made in the Terengganu oil field (Fig. 1) very near our cruise track, suggest that he was sampling the same corridor we visited; if so, the pathway may be somewhat wider than we detected.

The number of birds we observed (Tables 1 and 2) is small when compared with record counts for well-known migration pathways. However, our visit was brief and probably too late for detecting the bulk of migrating land birds. Simpson's (1983a) dates for 6 of 9 frequently encountered land birds near northeastern Borneo fell before the time of our visit, and, just as important, migrating land birds most often aggregate where land and water configurations encourage them to collect (e.g. on north or south projecting peninsula). By contrast, we were on the open sea where birds are much less likely to concentrate. Considering these factors, it seems likely that adequate spatial and temporal sampling will reveal many thousands of land birds moving south from Indo-China across the South China Sea.

Although our records and Simpson's (Wells 1990) 1982 observations demonstrate that a sizable migration is probably normal across the South China Sea, we should mention an alternate hypothesis that may help explain the presence of these birds where and when we observed them. First, our passage occurred when Typhoon Ruby was ravaging the Philippine Islands (Anon. 1989). Although we did not encounter heavy seas or strong winds, some of the birds we observed may have been forced out to sea, if non-migratory, or shunted away from their normal migration route, if migratory, by the storm.

TABLE 1
LAND BIRD TOTALS FOR R.V. AKADEMIK KOROLEV CRUISE TRACK SEGMENTS AND STATIONARY WATCHES IN THE SOUTH CHINA SEA, OCTOBER 1988

Station / Segment[2]			Duration	No. Land Birds Observed[1]					
		Length	of Obs.	Raptors		Non-raptors		All land birds	
Date	Number	(Km)	(min.)	Min.	cons.	Min.	Cons.	Min.	Cons.
23	1	38	88	0	0	0	0	0	0
	2	15	45	0	0	0	0	0	0
24	3	6	17	0	0	0	0	0	0
	4	67	158	0	0	0	0	0	0
	5	14	44	0	0	0	0	0	0
	6	19	48	0	0	0	0	0	0
	7	49	109	0	0	1	1	1	1
25	8	22	50	0	0	0	0	0	0
	9	3	11	0	0	0	0	0	0
	10	30	67	0	0	0	0	0	0
	11	17	38	0	0	0	0	0	0
	12	63	143	0	0	4	4	4	4
26-28	13	ca 0	912	22	30	32	44	54	74
28	14	ca 0	43	1	1	0	0	1	1
	15	22	10	0	0	0	0	0	0
	16	26	78	0	0	0	0	0	0
	17	ca 0	195	1	4	4	8	5	12
29	18	ca 0	105	1	1	1	4	2	5
	19	ca 0	20	0	0	0	0	0	0
	20	25	62	0	0	0	1	0	1
	21	ca 0	80	0	0	0	0	0	0
30	22	ca 0	23	1	1	3	3	4	4
	23	ca 0	110	0	0	2	4	2	4
	24	ca 0	25	0	0	0	1	0	1
	25	ca 0	95	0	1	3	3	3	4
	26	ca 0	54	0	0	0	0	0	0
	27	ca 0	52	0	0	3	5	3	5
	28	ca 0	30	1	1	0	0	1	1
31	28	ca 0	15	0	0	0	0	0	0
	29	ca 0	15	0	0	0	0	0	0
	30	135	280	1	1	3	3	4	4
Totals			3,022	28	40	56	81	84	121

[1]Because accurate bird counts were sometimes difficult to obtain for stationary watches (i.e., some birds remain aboard ship for an extended period), we report both the minimum (min.) number of birds observed (based on subtractive values) and a conservative (cons.) number based primarily on new arrivals. The actual number observed is believed to be about 20% higher than the conservative count.

[2]Cruise track segment locations are illustrated in Fig. 1.

TABLE 2

MINIMUM AND CONSERVATIVE LAND BIRD COUNTS ALONG CRUISE TRACK OF R.V. AKADEMIK KOROLEV IN THE SOUTH CHINA SEA, 23-31 OCTOBER[1, 2]

Species	Segments 1-7 (Oct. 23-24) Min. (Cons.)	Segments 8-19 (Oct. 25-29) Min. (Cons.)	Segments 20-30 (Oct. 29-31) Min. (Cons.)
Small juv. accipiter (*Accipiter* ap.)	0 (0)	14 (24)	3 (3)
Ad. Japanese Sparrow-hawk (*Accipiter gularis*)	0 (0)	2 (2)	0 (0)
Ad. Shikra (*A. badius*)[3]	0 (0)	1 (2)	0 (0)
Ad. Crested Goshawk (*A. trivirgatus*)[3]	0 (0)	2 (2)	0 (0)
Eagle/Kite (Accipitridae)	0 (0)	1 (1)	0 (0)
Peregrine Falcon (*Falco peregrinus*)	0 (0)	3 (3)	0 (0)
Oriental Scops Owl (*Otus sunia*)[4]	0 (0)	2 (2)	0 (1)
Chinese Pond Heron (*Ardeola bacchus*)	0 (0)	0 (0)	3 (3)
Watercock (*Gallicrex sinerea*)	0 (0)	1 (1)	0 (0)
Dove (*Streptopelia* sp.)[3]	0 (0)	1 (1)	0 (0)
Grey Nightjar (*Caprimulgus indicus*)	0 (0)	1 (1)	1 (1)
Fork-tailed Swift (*Apus pacificus*)	0 (0)	4 (4)	0 (0)
Swift (Apodidae)	0 (0)	2 (2)	0 (0)
Dollarbird (*Eurystomus orientalis*)	1 (1)	0 (0)	0 (0)
Barn Swallow (*Hirundo rustica*)	0 (0)	14 (29)	5 (10)
Swallow (*Hirundo* sp.)	0 (0)	1 (1)	0 (0)
Ashy Minivet (*Pericrocotus divaricatus*)[4]	0 (0)	1 (1)	1 (1)
Lanceolated Warbler (*Locustella lanceolata*)[4]	0 (0)	1 (1)	1 (1)
Great Reed Warbler (*Acrocephalus arundinaceus*)	0 (0)	1 (1)	0 (0)
Warbler (*Acrocephalus* sp.)	0 (0)	1 (2)	1 (1)
Arctic Warbler (*Phylloscopus borealis*)	0 (0)	0 (0)	1 (1)
Flycatcher (*Ficedula* sp.)	0 (0)	2 (2)	0 (0)
Brown Shrike (*Lanius cristatus*)	0 (0)	6 (6)	1 (1)
Unidentified passerines or remains	0 (0)	5 (8)	0 (1)
Totals	1 (1)	66 (96)	17 (24)

[1]Cruise track segments and stations are illustrated in Fig. 1 and described in Table 1.

[2]Abbreviations in column headings are: Min. (minimum count) and Cons. (conservative count) as explained in Table 1, Footnote 1.

[3]Because these birds are considered non-migratory, these identifications should be treated as tentative. All are based on nearby visual observations aided by 10 x binoculars, but without photographic or other substantiation.

[4]Individuals of these species were deposited in the U.S. National Museum: Oriental Scops Owl, USNM No. 607190: Ashy Minivet, USNM No. 607193; and Lanceolated Warbler, spirit specimen (not assigned numbers at USNM).

TABLE 3
PHYSICAL CONDITION AND MIGRATORY STATUS OF LAND BIRDS ARRIVING ON R.V. AKADEMIK KOROLEV, 25-29 OCTOBER 1988, SOUTH CHINA SEA[1,2]

		Mobility Classes[4]				
Physical Condition[3]	Taxon (Number)	Known Migrant	Known Over-water Migrant[5]	Known Colonizer of Islands	Known Straggler to Islands	Comments
Good	Japanese Sparrow-hawk (*Accipiter gularis*) (2)	+	-	-	-	Common migrant.
Good	Shikra (*A. badius*) (2)	+	-	-	-	Western population is highly migratory; eastern population migratory in Malasia.
Good	Crested Goshawk (*A. trivirgatus*) (2)	-	-	-	-	Non-migrant throughout range.
Good	Peregrine Falcon (*Falco peregrinus*) (3)	+	+	+	+	
Fatigued	Watercock (*Gallicrex cinerea*) (1)	+	-	-	-	Winters in Greater Sunda Islands and Celebes; very few records as straggler.
Good	Dove (Streptopella sp. (1)	-	-	-	-	
Emaciated	Oriental Scops Owl (*Otus sunia*) (1)	+	-	-	-	
Good	Grey (Jungle) Nightjar (*Caprimulgus indicus*) (1)	+	+	-	+	Strongly migratory, scatters across Malasia in winter.
Good	Fork-tailed Swift (*Apus pacificus*) (4)	+	-	-	-	A few migratory stragglers recorded as far east as Marshall Islands.
Good	Barn Swallow (*Hirundo rustica*) (29)	+	+	-	+	Winters throughout region and tropics world wide.
Fatigued	Ashy Minivet (*Pericrocotus divaricatus*) (1)	-	-	-	-	Winters on larger islands of Indonesia, but not on islands separated by large bodies of water.
Fatigued	Lanceolated Warbler (*Locustella lanceolata*)	+	-	-	-	Winters in Greater Sunda Islands.
Good	Great Reed Warbler (*Acrocephalus arundinaceus*) (1)	+	+	-	+	Common migrant in Indonesia.
Good	Brown shrike (*Lanius cristatus*) (6)	+	+	-	-	Common migrant to Greater Sunda Islands; recorded in Palau.

[1]Data are included only for that portion of the cruise track (stations 8-19) where the ship was far (over 100 km) from land.

[2]Assignment to mobility class (i.e., regular migrant over land and overlarge bodies of water, colonizer of distant land masses and islands as a breeding bird, straggler either on migration or as a resident) is at best tentative for some species, but was largely made from information in Brown and Amadon (1968), Clements (1978), King and Dickinson (1975), Medway and Wells (1976), and Pratt *et al.* (1987).

[3]Physical condition was reported Good, if bird flew well and was adept at avoiding capture by hand; Fatigued, if readily captured by hand; and Emaciated, if sternum was sharply protruding upon capture.

[4]Symbols in these columns: + = yes, - = no.

[5]Those species scored as + in this column are known to regularly cross large bodies of water (> 500 km) on migration.

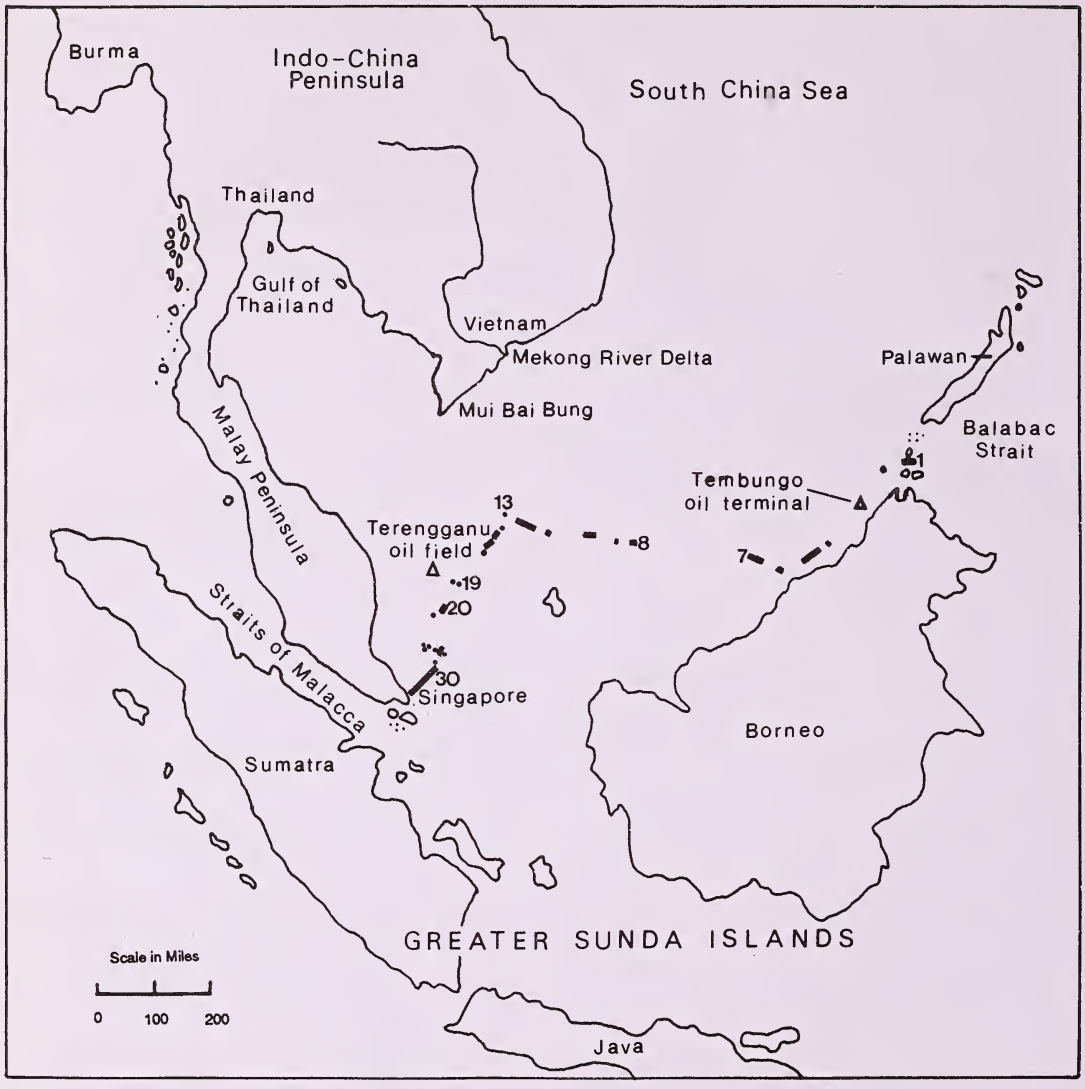

Fig. 1. Geography of the southern half of the South China Sea showing bird survey locations. Numbered segments are bird survey locations for *R.V. Akademik Korolev*, 23-31 October 1988.

However, most of the birds we observed far from land (Table 3) are known to be strong migrants. The four hawks tentatively identified as Shikras (*Accipiter badius*) and Crested Goshawks (*A. trivirgatus*), and the dove (*Streptopelia* sp.) are the only real surprises although a few others in Table 3 would not be expected this far from land.

Flight direction may give some indication of the likelihood of either hypothesis. If the birds were displaced migrants, they would probably have been heading southwest (i.e. away from the storm). If in passage from a concentration zone on the Indo-China Peninsula to Borneo, they should have been heading southeast to encounter our vessel. If, as we observed, the raptors (33% of all land birds) were foraging at sea (Ellis *et al.* 1990) rather than

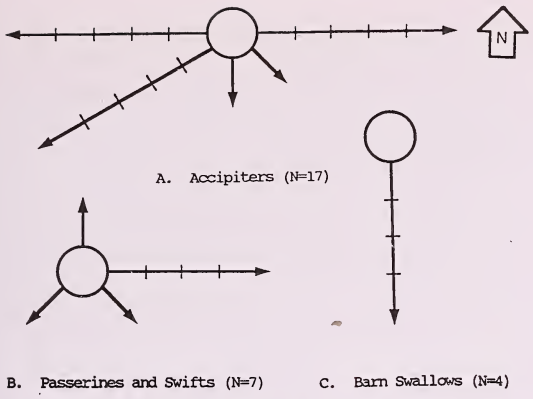

Fig. 2. Arriving and departing flight directions for birds seen on cruise track segments 8-19 of R.V. *Akademik Korolev*, 26-29 October 1988.

migrating, there would likely be no consistent trend in their flight direction. In Fig. 2, there is no clear east-west trend in arriving or departing flights. However, although the data are very few, a strong southward component is evident. In constructing Fig. 2, we eliminated directional readings for birds seen on cruise track segments 1-7 and 20-30 because these segments were near enough to land (i.e. within 100 km) that the birds' flight directions would probably have been influenced by sight or sign of nearby land. In addition, flight bearing could have been influenced by the presence of the ship.

Physical condition of the birds we observed may also be an indicator of the regularity with which this migration route is used. If a high proportion of the known overseas migrants were in good body condition this far from land, it is more tenable to suppose that these species regularly use this route. In Table 3, our best estimate of physical condition is compared for all species encountered far from land. We know from handling a few captives, and infer from the energetic flight of others, that the raptors and the Barn Swallows at station 13 were in good physical condition. For the other species, too few individuals were present to draw firm conclusions, but all individuals of most species appeared to be in good condition.

A final hypothesis may explain the presence of some of the raptors. Many of these were opportunistically foraging at sea. During the 3-day waiting period (Fig. 1, station 13), we recorded raptors perching for extended periods, roosting nightly on the ship, and engaging in at least 21 hunting forays. Of 14 forays for which the outcome was known, 13 (93%) were successful. Some accipiters even used the ship's deck lights to forage at night. We gathered prey remains during the 3-day period consisting of at least 20 kills. Two species, the Barn Swallow and the Brown Shrike (*Lanius cristatus*) suffered heavy mortality from predation. Of 14 Barn Swallows (minimum count) observed from 25-29 October, at least 7 turned up as prey. Even more significant, 5 of 6 (minimum count) Brown Shrikes seen during the same 5-day period were observed as prey. Simpson's (1983a and Wells 1990) observations of raptor behavior at both oil fields led him to conclude that Japanese Sparrowhawks (*Accipiter gularis*) were hunting and "commuting between nearby rigs". Our observations confirm that the raptors were opportunistically using our stationary ship for perching, roosting, and hunting. When the ship was moving under power, however, none of the raptors perched for any extended period and none roosted on the ship.

From all available evidence, it seems most likely that the birds we encountered were a small part of what must be a sizable wave of fall migrants on their way across the South China Sea. The configuration of the land masses suggests that the point of departure for these birds was the southern tip of Indo-China; however, further land-based research is needed to substantiate the point of origin and destination of birds crossing the South China Sea to Borneo. Additional work at sea will also be helpful in determining the timing and magnitude of the migration, as well as corridor width. Work on islands in the South China Sea or stationary platforms may substitute in part for the at-sea studies, but it is important to examine birds on arrival in the Greater Sunda Islands to determine body condition. Intensive banding operations in Viet Nam, at sea, and in Borneo could reveal much about survival rates and all other aspects of this little known migration route.

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NEW DESCRIPTIONS

A NEW SPECIES OF GENUS *GLYPTOTENDIPES* KIEFFER (DIPTERA : CHIRONOMIDAE) FROM INDIA[1]

T.K. Dutta and P.K. Chaudhuri[2]

(With six text-figures)

Kieffer (1913) erected *Glyptotendipes* as a genus in the family Chironomidae with *G. sigillatus* as its type which was described later by Kieffer (1922). Various chironomidologists of the past considered it as one of the subgenera of *Chironomus* Meigen but it is now recognised as a full genus in the family. The genus is least represented from the Afrotropics, Micronesia, Australia and Oceania regions. In India, four species, *barbipes* (Staeger), *melanostolus* (Kieffer), *oriplanus* (Kieffer) and *verrucosus* (Kieffer) were recognised before this investigation. In this paper, one new species of the genus, *Glyptotendipes pilosus* is described from the duars of the Himalayas of West Bengal. Terminologies and usages followed in this paper are after Saether (1980) and Chaudhuri and Chattopadhyay (1990).

Glyptotendipes pilosus sp. nov.

MALE: Body length 3.86 (3.64-3.89, n=10), wing length 2.01 (1.80-2.01, n=10) and wing breadth 0.58 (0.56-0.63, n=10). [Measurements in millimeter (mm)].

Head: Vertex with 20-22 IV 4, OV 16-18 and PO 0 setae. Corona with 7-8 setae. Clypeus with 15-16 long setae, clypeal ratio 0.85. Maxillary palp light brown, length ratio of palpomeres I-V 10: 13: 35: 26: 28, L/W ratio 4.37. Eyes reniform with a dorsal extension of 0.11. Antenna dark brown, length ratio of flagellomeres I-XI 6: 7: 7: 6: 6: 6: 6: 7: 7: 7: 192, AR 2.95; CA 0.66; CP 1.60.

Thorax: Dark brown, Antepronotum wide at the base with a median narrow "V" shaped emergination, antepronotal 0; mesonotum with 3 dark vittae, acrostichals 2-3, dorsocentrals 8-10, humeral 0, prealars 4 and scutellars 6 in transverse row, postnotum dark brown and bare.

Wing (Fig. 1) hyaline with coarse microtrichia. Brachiolum with 2 setae and 15-16 sensilla companiformia; 18, R1, 15-16 and R+5 with 20-22 setae. RM little proximal to FCu, An ends just below FCu. Squama fringed with 10-12 setae. Haltere light brown and bare. CR 1.01; VR 1.06.

Legs: Femora and tibia of all legs yellow, fore tibia dark brown and tarsomeres of all legs dark brown. Fore tibia with a blunt scale (Fig. 2) bearing 4 apical setae. Spurs of mid tibia equal 0.027 long, ratio of spurs to the apical diameter of mid tibia 9:8; spurs of hind tibia unequal 0.021 and 0.015 long, ratio of length of spurs to the apical diameter of hind tibia 7:13 and 5:13.

Abdomen yellow with more or less dense scattered setae. Tergites II-VIII each with a characteristic mid dorsal horse-shoe shaped or racket like impression. Hypopygium (Fig. 3) with long tubular anal point 0.039 long having 4 setae at each basal margin. Gonocoxite massive more or less conical, with 14-15 strong setae over it; gonostylus also massive strongly pubescent and attenuated near the apex with 5 minute setae at its inner apical margin. Superior volsella (Fig. 4) digitiform hooked inward at its apex and without setae beyond the base; inferior volsella stout, long with numerous incurved apical setae. Transverse sternapodeme 0.045, lateral sternapodeme 0.078, coxapodeme 0.03 and phallapodeme 0.054 long. HR 0.71, HV 3.45.

FEMALE: Body length 4.14 (3.92-4,38, n=4), wing length 2.04 (1.98-2.12, n=4) and wing breadth 0.63 (0.62-0.66, n=4).

Similar to male with usual sex differences. Antenna (Fig. 5) light brown, flagellomeres II-IV long necked flask like, length ratio of flagellomeres

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I-V 9 : 9: 8: 7: 12, AR 0.36. Genitalia (Fig. 6): Notum 0.85 long. Gonocoxapodeme VIII blunt or pouch like. Coxosternapodeme stout well developed and more or less bowed. Gonapophysis VIII divided into a broad shallow dorsomesal lobe and a stout leaf-like ventrolateral lobe, apodeme lobe weak and bent. Postgenital plate relatively small and narrowed down to assume a V-shape. Seminal capsule more or less equal, oval 0.99 long by 0.051 wide, ducts of capsule without loop opening into the vagina by a single aperture. Cerci well developed and finely setose.

Holotype Male (Type no. 209, B.U. Ent.), Birpara, West Bengal, 15. ix. 1985, Coll. T.K. Dutta. *Allotype* Female, data same as holotype. *Paratypes* 4 males and 3 females, Birpara, 15.x.1986, Coll. T.K. Dutta; 3 males, Jalpaiguri,

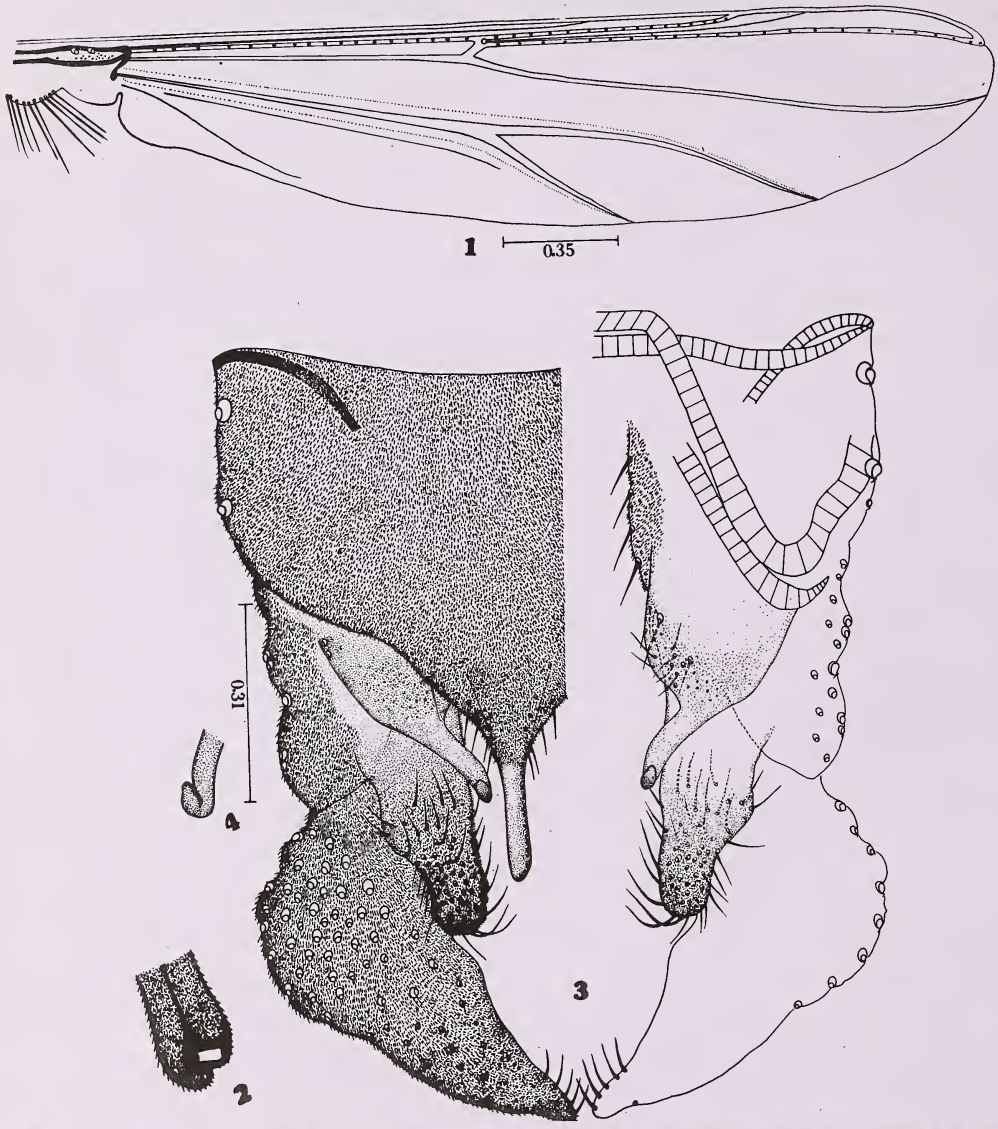
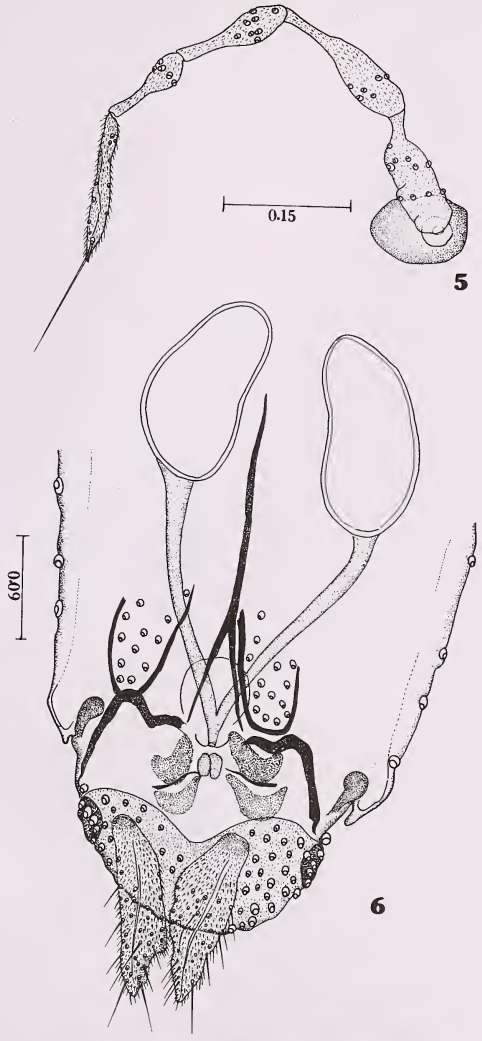


Fig. 1-4. *Gyptotendipes pilosus* sp. nov.: 1. Wing; 2. Fore tibial scale; 3. Hypopygium; 4. Superior volsella of male.

PROPORTION AND RATIO OF LEG-SEGMENTS

	Fe	Ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV	BR
Fore	62	49	38	18	15	10	77	0.77	2.98	3.46	1.75
Mid	60	52	34	16	10	9	7	0.65	3.47	4.30	3.75
Hind	65	70	52	27	22	11	9	0.74	2.71	3.21	1.80



Figs. 5-6. *Glyptotendipes pilosus* sp. nov.
5. Antenna and 6. Genitalia of female.

West Bengal, 12.vi.1984, Coll. P.K. Chaudhuri; 4 males, Madarihat, West Bengal, 14. iii.1988, Coll. T.K. Dutta. All are kept in the collections of insects at the Department of Zoology, University of Burdwan and will be deposited to suitable depositors shortly.

Remarks: In view of the hairy style, the species is named as *Glyptotendipes pilosus*. It appears to be very similar to *G. tokunagi* (Sasa 1979) in respect of gonocoxite, gonostylus, superior and inferior volsella but differs from it in colour pattern of abdomen and fore legs and apical expansion of the anal point. The species also resembles *G. pallens* (Meigen) and *G. seminole* Townes (1945) in superior and inferior volsella of male hypopygium. The following combination of characters segregate the new species from previously described species of *Glyptotendipes* Kieffer : i) scutellars 6 small in transverse row, ii) abdomen yellow and densely setose, iii) long tubular anal point, iv) gonostylus stout, strongly pubescent and attenuated near apex, v) superior volsella digitiform, apically curved and bare, vi) inferior volsella stout, elongate with profuse long, curved apical setae and vii) female genitalia with weak apodeme lobe, V-shaped postgenital plate and two approximately oval and equal seminar capsules.

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MAPANIA ARUNACHALENSIS — A NEW SPECIES OF CYPERACEAE FROM ARUNACHAL PRADESH, INDIA[1]

G. D. PAL[2]

(*With a text-figure*)

A new species of the genus *Mapania* Aubl. (Cyperaceae) is described with illustrations. A tabulated key for the allied species is also provided.

Mapania arunachalensis sp. nov.

M. kurzii Clarke proxime affinis, sed scapis sparsim strigosis ad apicem, bracteolis cum striationibus plus quam 15, bracteisque majoribus triangularibus vel ovato-oblongis, distinguenda.

Typus: Holotypus lectus a G.D. Pal ad locum Arunachal, Inferior Subansiri district, Itanagar *c.* 400 m, dia 27.3.1979, sub-numero 72507, et positus in CAL. Isotypus positus in ARUN.

Erect, rhizomatous perennial herbs, 1-1.75 m high. *Rhizomes:* 2.5 cm long, 0.5-1 cm across, partly covered with stiff, imbricate scales; scales broadly ovate, 2-5 x 1.5-3.5 mm, deep brown. *Stems:* stout, cylindric, 1.5-3 cm long and 1-1.5 cm across, enclosed by the cauline leaves. *Scaly leaves:* lowermost broadly ovate to ovate-orbicular, 0.8-2.5 x 0.6-2 cm, margin scarious; upper ones ovate-lanceolate, keeled, 4-12 x 2-3 cm, gradually tapering to the stiff apex, margin scarious, turn greyish-brown on drying. *Leaves:* densely equitant, linear, (125-)150-175 (-200) x (2-) 2.2-2.8 (-3) cm, prominently keeled; apex long attenuate, flagellate and distinctly trigonous; margin subentire to distantly serrulate towards base, closely denticulate upward, teeth strong, recurved; midrib finely channelled above, distinctly raised beneath, closely or distantly sharp spinescent as those of margins; venetion parallel, more or less prominent; subcoriaceous, scabrous, whitish hairs along margin towards apex, dull green to pale brown on drying. *Inflorescence:* scape solitary, lateral, 25-40 cm long, longitudinally ribbed and furrowed, terete or slightly compressed with more or less dilated, trigonous, strigose apices, about one-third length at base covered with 8-12 equitant scales; lower scales suborbicular to broadly ovate, (0.5-) 1-2 (-2.5) x (0.4-) 1-1.5 (-1.8) cm, apex acute, incurved; upper scales ovate-oblong, 4-6.5 x 1.8-2.2 cm, apex acuminate, incurved, margin scarious. *Spikes:* 4-6 in compact capitate head, ellipsoid, 1.5-2 cm long, subtended by 4-6 bracts; bracts triangular, ovate-oblong or oblong, 2-2.5 x 1.4-1.8 cm, acute, scabrous, margin scarious, sometimes lacerate towards bracteoles in 6-8 series, (2-) 3(-4) in each whorl, concave, midrib often keeled, sparsely to densely strigose or glabrous: 1st series oblong, 1.8-2 x 1-1.2 cm, keeled, apex fimbriate; 2nd series oblong, 1.5-1.8 x 0.9-1 cm, midvein prominent but not keeled, sparsely strigose along the midvein, brownish streaks scattered, apex lacerate; 3rd and 4th series broadly-oblong, 1.5 x

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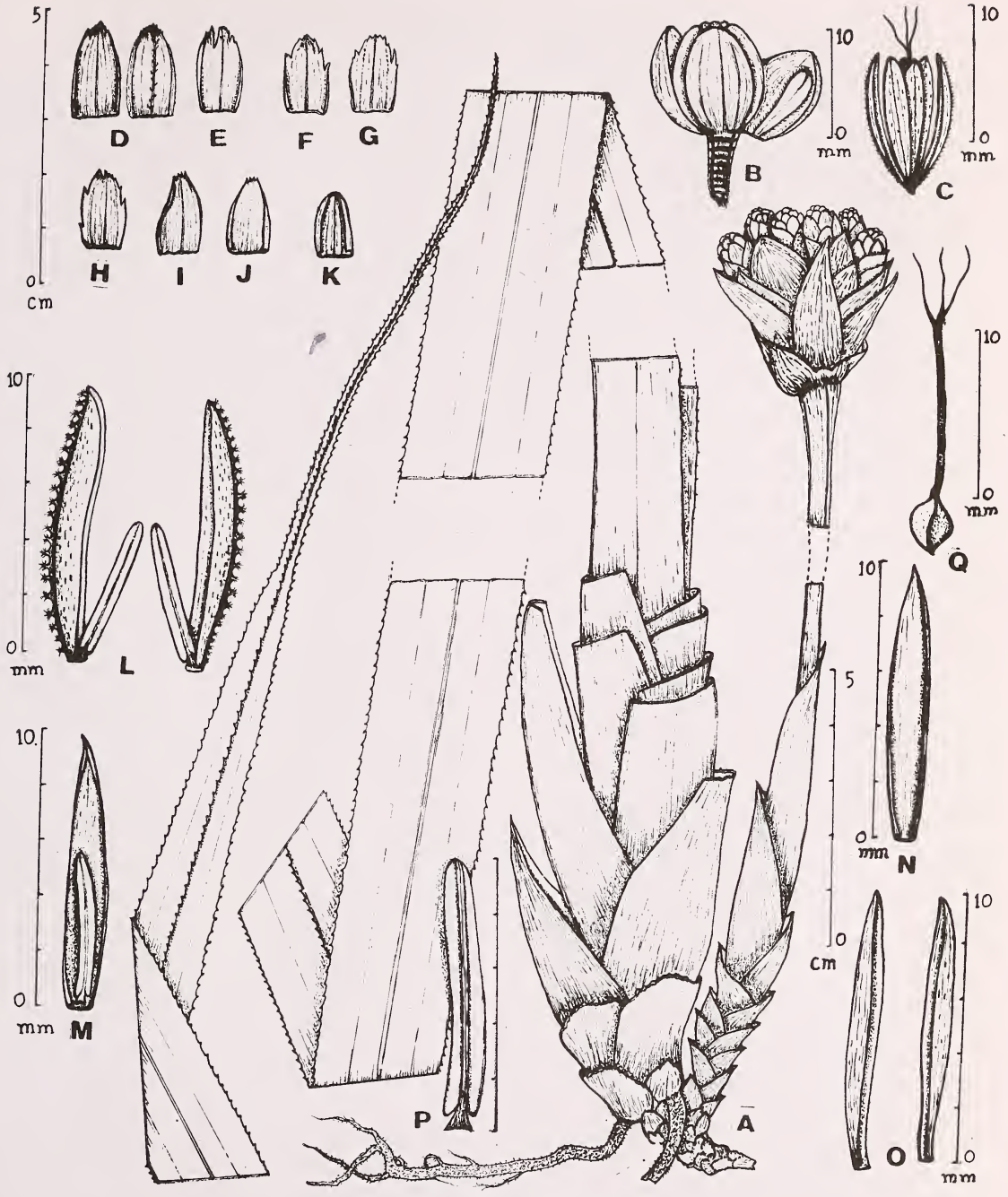

Fig. 1 (A-Q). *Mapania arunachalensis* sp. nov.
A. Habit; B. Spike; C. Flower; D. Bracteoles (First series ventral and dorsal view respectively); E-K. Bracteoles (Second to Eighth series respectively); L. First and second glume (monandrous); M. Third glume (monandrous); N-O. Glumes (empty); P. Stamen; Q. Gynoecium.

A TABULATED KEY FOR THE THREE SPECIES

Mapania palustris (Hassk. ex Steud.) F. Vill.	*Mapania arunachalensis* sp. nov.	*Mapania kurzii* Clarke
1. Leaves *c.* 4 cm broad, margin scabrous, acutely scabrous on keel beneath, apex neither flagellate nor acutely trigonous.	Leaves 2-3 cm broad, margin closely denticulate acutely spinescent on the keel beneath, apex flagellate, distinctly trigonous.	Leaves *c* 2.5 cm broad, margin rigid harse, keel rigid harse, long attenuate trigonous.
2. Scapes 30-60 cm long, glandular scabrous upward.	Scapes 25-40 cm long, very sparsely strigose near the apex.	Scapes 10-40 cm long, smooth upward.
3. Scapes covered basally by a few sheaths or scaly leaves.	One-third part of the scape covered basally by scaly leaves.	Scapes covered basally by a few sheaths.
4. Heads composed of 10-50 spikes.	Heads composed of 4-6 spikes.	Heads composed of 1-15 spikes.
5. Bracts ovate-oblong, 1.5-2 cm long.	Bracts triangular or ovate-oblong, 2-2.5 cm long.	Bracts short, ovate.
6. Bracteoles less than 10 mm long, 3-5 striate	Bracteoles usually 15-18 mm long, 15-25 striate.	Bracteoles small, up to 10 mm long, strongly 13-striate.
7. Spikes 15-20 mm long.	Spikes 15-20 mm long.	Spikes 12-13 mm long.
8. First pair of glume ciliolate on the keel.	First pair of glume stellate hairy with distinct stalk on the keel.	First pair of glume ciliolate on the keel.
9. Third glume empty	Third glume monandrous.	Third glume monandrous.

0.9-1 cm, not keeled; 5th to 7th series oblong, 1.5 x 0.7-0.8 cm, not keeled, brownish streaks scattered; inner most series broadly oblong, 1.1-1.3 x 0.6-0.7 cm, brownish streaks concentrated towards base and along midrib like those of flowering bracteoles. *Spikelets:* each spikelet subtended by a chaffy bracteole; bracteoles deeply concave, elliptic-oblong, 11-13 x 6.5-8.5 mm, obtuse, margin scarious or rarely lacerate towards apex, longitudinally veined, brown streaks scattered, glabrous; flowers bisexual, dorsiventrally compressed. *Glumes* 6, almost biseriate, linear-oblong, concave, membranous: First and second glumes 10-12 x 1.5-2 mm, distinctly keeled, hairs stellate with a short stalk, deep brown streaked, monandrous; third glume opposite to posterior glume, 10-12 x 1-1.5 mm, not keeled, pale brown with scattered streaks, monandrous; three other glumes almost in a single whorl; fourth glume opposite to anterior glume, 9-11 x 1.25-1.75 mm, sparsely brownish streaked towards apex, empty; fifth and sixth glumes enclosing gynoecium almost at right angle to previous glumes, 9-10.5 x 1-1.5 mm, brownish, sparsely streaked, empty; stamens 3, filaments *c* 0.5 mm long; anthers linear-oblong, dorsiventrally flattened, 5-6 mm long; ovary ellipsoid with cuneate base, 4-5 x 3-3.5 mm; style continuous, 10-15 mm long, wiry, about two-third connate at base, 3-branched above, sometimes branches unequal.

Fls.: March-April.

Ecol.: In moist and shaded places on thick humus in primary forests and along streams.

Distribution: INDIA: Arunachal Pradesh, Lower Subansiri district, Itanagar *c.* 400 m, 27.3.1979, *G.D. Pal* 72507 A (Holotype-CAL). Isotype: *G.D. Pal* 72507 B (ARUN).

Note: The species is closely allied to *M. kurzii* Clarke but can be distinguished by its scapes being sparsely strigose at the apices, the larger bracteoles with more than 15 striations and larger triangular or ovate-oblong bracts. The species also comes near to *M. palustris* (Hassk. ex Steud.) F. Vill. but the former can be easily distinguished by the third monandrous glume, nature of leaves, scapes and bracteoles.

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ON A NEW SPECIES OF *SPATHIUS* NEES (HYMENOPTERA : BRACONIDAE) FROM INDIA[1]

S.M. KURHADE[2] AND P.K. NIKAM[3]

(With three text-figures)

Spathius deccanensis sp. nov. is described and illustrated.

INTRODUCTION

Spathius is a moderate sized genus of the subfamily Spathiinae. Nees (1818) erected this genus with the type species, *Cryptus clavatus* Panzer. Other species reported are *Stenophasmus ruficeps* Smith (1859), *Euspathius* Foerster (1862) and *Rhacospathius striolatus* Cameron (1905).

Spathius comprises about 291 species distributed world wide, from which 204 species are recorded from Indo-Australian and Pacific region and 17 species are known from India (Shenefelt and Marsh 1976). *Spathius* has been divided into 55 species groups by Nixon (1943). The taxa studied here belongs to the *vulnificus* group.

The earlier works on *Spathius* in Indo-australian region are by Motschoulsky (1863), Westwood (1882), Szepligeti (1905, 1908), Cameron (1908, 1910), Enderlein (1912), Brues (1918), Wilkinson (1931), Nixon (1939, 1943), Krishna Ayyar and Narayanswami (1940) and Granger (1949).

In this study the key to the species of the *vulnificus* group of *Spathius* of the old world by Nixon (1943) is followed and the new species, *Spathius deccanensis* described from India in Indo-Australian region is included in the key.

Types and other material of the species are in the collection of the junior author for the time being and will be deposited in the National Collection of the Zoological Survey of India, Calcutta, India in due course.

Spathius deccanensis sp. nov.

FEMALE: 4.9 mm. in length (Fig. 1). Head (Fig. 2): 0.7 times the own width; vertex smooth, moderately, shallowly punctate, pubescent; interocellar distance 0.42 times the ocellocular distance; frons transversely striate; face 0.55 times the own width, transversely strigose, moderately punctate, pubescent; clypeus narrow, 0.25 times the own width; malar space as long as basal width of mandible, smooth, weakly punctate, pubescent; mandible 2 x as long as its basal width, bidentate, overlapping; temple 0.45 times the length of eye, smooth, subpolished, very weakly, shallowly punctate, pubescent; maxillary palp 5 segmented.

Antenna: 2 + 47 segmented; scape 2 x as long as wide, shorter than first flagellar segment; pedicel 1.25 x as long as wide; post pedicel 8 x as long as wide; penultimate segment 4 x as long as wide; terminal segment 6 x as long as wide.

Thorax: Pronotum strigose; mesonotum coriaceous; middle lobe of mesoscutum transversely strigose, pubescent; lateral lobes of mesoscutum rugoso-reticulate, pubescent; notauli distinct; prescutellar depression with five transverse carinae; scutellum shiny, smooth; mesoplerum smooth, shiny, very weakly, shallowly punctate, anterior corner with transverse carinae, pubescent; prepectal carina distinct, transversely carinated; mesopleural fovea prominant; speculum smooth, shiny; metapleurum rugoso-reticulate; propodeum (Fig. 3) areolated; areola quadrangular, 1.42 x as long as wide, with four transverse carinae; first and second pleural areas transeversely carinated; first and second lateral areas smooth, shiny, pubescent; propodeal spiracle small, rounded. Hind coxa : 1.65 x as long as wide, transversely striate, with long pubescence; trochanters I + II 4.2 x as long as wide; femur 4 x as long as wide; tibia 1.5 x as long as femur, 13.4 x as long as wide apically; long tibial spur 0.25 times the basitarsus; basitarsus 0.6 times the femur; tarsus 5 segmented; claw simple, bifid.

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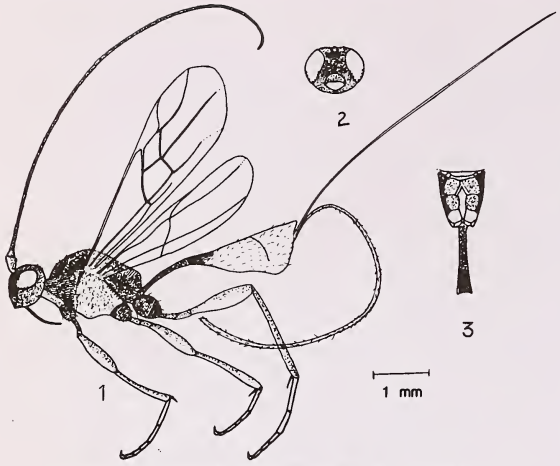

Figs. 1-3. *Spathius deccanensis* sp. nov. female
1. Adult, Lateral view; 2. Head, viewed from front;
3. Propodeum with first abdominal tergite.

Fore wings: 3.85 x as long as broad; stigma 6 x as long as wide; costa 2.8 x as long as stigma; first abscissa of radius as long as width of stigma; second abscissa of radius 3.4 x as long as first abscissa; third abscissa of radius 6.6 x as long as first abscissa 1.9 x as long as second abscissa; first intercubitus 2 x as long as basal; nervulus vertical, opposite, 0.8 times the width of stigma; submedius as long as medius; subdiscoideus 1.5 x as long as stigma.

Hind wings : 5.4 x as long as broad; mediella 3.75 x as long as basella; cubitella as long as mediella; nervulus reclivous, basad, 0.5 times the basella; post nervulus opposite.

Abdomen: 3.6 x as long as wide, petiolate, spindle shaped; first tergite strongly petiolate, 7.85 x as long as wide, rugose, closely punctate, with long pubescence, striate apically, two mid-dorsal longitudinal carinae present on apical 0.3 region; second tergite as long as wide apically, smooth, polished, pubescent; third tergite 0.6 times the apical width, smooth, polished, pubescent; remaining tergites smooth, polished, pubescent; ovipositor very long, 3.9 x as long as hind basitarsus; ovipositor sheath as long as ovipositor, longer than abdomen, pubescent throughout the length.

Coloration: Reddish-brown. Head, antenna, legs yellowish red; propodeum, tips of mandibles black; stigma, veins, ovipositor sheath brownish-black; mesopleurum brown.

MALE: Unknown.

Holotype: Female, INDIA; Maharashtra: Ahmednagar, 10. ix. 1989 on wing, S.M. Kurhade coll.; Regd. No. Br sp[1]/MUZ/SMK1; Antenna, wings and legs mounted on slides and labelled as above.

Paratypes: 17 females, data same as holotype, except 5 females 7. x. 1989.

Comments: In accordance to the key to the species of the *vulnificus* group (Nixon 1943) of the genus *Spathius*, the new species, *Spathius deccanensis* is close to *Spathius vulnificus* (Wilkinson 1931) and resembles it in having : (i) reddish-brown body, (ii) coriaceous mesonotum, (iii) distinct notauli and (iv) propodeum areolated, with four transverse carinae. However, the new taxa differs from the same in having : (i) transversely striated frons, (ii) vertex smooth, (iii) malar space smooth, (iv) flagellum 47 segmented, (v) scape shorter than first flagellar segment, (vi) mesoplerum smooth, (vii) first tergite rugose, (viii) tergites 2 and 3 smooth, polished and (ix) ovipositor sheath longer than abdomen.

The new species also superficially resembles *Spathius sul* (Nixon 1943), but differs from the same in having: (i) reddish-brown body, (ii) face transversley strigose, (iii) frons transversely striate, (iv) mesoplerum smooth, shiny, very weakly, shallowly punctate and (v) tergites 2 and 3 smooth, polished.

A KEY TO THE SPECIES OF *vulnificus* GROUP FEMALES OF *Spathius* BY NIXON (1943)

1. Wings vestigeal. Yellowish-brown species with the abdomen except tergites 2 and 3 which are pale in part, blackish; tergites 2 and 3 except for the narrow apical margin, finely longitudinally striate ..... *critolaus* Nixon (1939)

- Wings fully developed 2

2. Tergites 2 and 3 dull, extremely closely reticulate, appearing finely rugulose, almost shargreened species with tergites 2 and 3 having the basal half entirely yellow and a yellowish spot on each side of apical half ..... *sul* Nixon (1943)

- Tergites 2 and 3 differently sculptured 3

3. Tergites 2 and 3 smooth, without a yellowish semicircular area at base ..... *deccanensis* sp. nov.

- Tergites 2 and 3 yellowish at base 4

4. Tergites 2 and 3 with yellowish semicircular area at the base, finely, obliquely aciculate; beyond this area almost smooth; 2nd abscissa of the radius of the forewing only slightly more than half the length of the 3rd; ovipositor longer ....*vulnificus* Wilkinson (1931)

- Tergites 2 and 3 yellowish at base but without this colour being restricted to a semicircular area in greater part, finely longitudinally striated; 2nd abscissa of radius about 2/3 of the length of the 3rd; ovipositor shorter ..... *critolaus* Nixon (1939)

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MISCELLANEOUS NOTES

1. SOME OBSERVATIONS ON THE BREEDING AND LONGEVITY OF LION-TAILED MACAQUE (*MACACA SILENUS*) IN CAPTIVITY

A pair of adult lion-tailed macaque (*Macaca silenus*) was received from the National Zoological Park, New Delhi in January, 1982 and displayed in one of the monkey islands surrounded by a water moat of 7 metres width at the Nandankanan Biological Park, Orissa. The land area of the circular island with 12 metres diameter and 2.50 metres deep including the 0.60 metre high parapet on the viewer's side. The shelter house in the centre of the island measures 2.70 x 1.50 x 2.10 metres. The island has natural growth of vegetation. The zoo diet of these macaques consists of a variety of fruits, vegetables, greens, bread, milk and cooked rice. They have also free access to insects in the natural vegetation.

During the period from January 1982 to June 1991, the female of this pair and their two female offsprings gave birth to nine young including two still-births. There was always one young born. Births have taken place in January, 4; March, 2; October, 1 and November, 2. The inter-parturition interval recorded four times in one female (Dates of birth: 4-10-1983, 28-3-1985, 21-1-1987, 3-11-1988 and 16-3-1990) varied from 1 year, 4 months and 13 days to 1 year, 9 months and 24 days with a mean of 1 year, 7 months and 11 days. The two zoo-born females gave birth to their first young at the age of 3 years, 9 months and 29 days and 4 years, 3 months and 16 days respectively. The two still-born male young weighed 417-495 gm (mean 456 gm) and measured 39-42 cm (mean 40.50 cm) from tip of the nose to tip of the tail including 12.50-14.00 cm (mean 13.25 cm) long tails.

One adult female living in the park since January 29, 1966 died on June 16, 1984 after remaining for 18 years, 4 months and 18 days in captivity at an estimated age of 20 years.

Usually all primates produce their young singly and in the wild new born young of this species are seen regularly in September in South India (Prater 1980). There is only one set of twins in 309 births recorded in North American Zoos during 1932-1982 and 305 births for which birth dates are available occur in all the months of the year with minimum of 20 during August to a maximum of 33 in April and December with no evidence of seasonality in reproduction (Lindburg *et al.* 1989). According to Walker *et al.* (1964) all the *Macaca* species usually produce one young but occasionally twins are born. At Delhi Zoological Park 15 births are recorded from March to November with the maximum number of births in April and May (Desai and Malhotra 1976).

The sex ratio at birth was strongly in favour of males (58.5%) which is similar to the present limited findings (Lindburg *et al.* 1989). They further stated that the mean inter-birth interval was 17.3 months for lactating mothers (14.2 months for non-lactating mothers) and the age of sexual maturity for females of this species is given as about 4 years. The birth weight is given as 450 gm (Parker 1990) and 348.8 gm for one specimen (Crandall 1965).

The life span for all species of *Macaca* in general is given as 30 years or more (Walker *et al.* 1964) and for this species as over 20 years (Parker 1990). The maximum longevity recorded for this species is 17 years and 7 months (Jones 1962) and at Rotterdam Zoo one specimen of this species lived for 16 years, 11 months and 16 days (Flower 1931).

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2. NOTES ON THE LARGE-EARED HEDGEHOG, *HEMIECHINUS AURITUS* GMELIN

Introduction

The present study was undertaken to collect information on the habitats and habits of hedgehogs in the rural areas of Etawah and Kanpur districts of Uttar Pradesh.

Materials and Methods

The animals were trapped by setting twenty traps baited with a piece of meat for 2-3 consecutive nights at random in each month of a calendar year. The traps were placed under hedges in different localities of rural areas of Etawah and Kanpur districts. These are relatively open areas with varied habitats including dense Eucalyptus, small to medium size dense shrubs and scattered trees. At times, burrows were also dug out to capture the animals. Overall, trapping was done 25 times in a year. The percentage of trapping success is depicted in Table 2.

Animals trapped from the wild were kept under seminatural condition in a terrarium (90 x 45 x 45 cm) fixed on the ground by the side of the animal house located in the college campus. The soil surface was covered with 90 cm of sand. Animals were released in the terrarium for about a week to acclimatize them to the conditions and then visual observations were made for 30 min. each day for 21 days on burrowing pattern and other activities. For studying the activity in the burrow, the opening of the burrow in the terrarium was covered with a glass pane. Even after this change the hedgehogs continued to use the tunnel. Sometimes, a burrow was dug out to study the internal structure and depth of the burrow.

Field work was also carried out to study burrow, habitat selection, and diurnal and annual activity from April 1992 to March 1993. Each trapped hedgehog was sexed and weighed. Physical measurements were recorded (Table 1). The animals were individually marked with paint and released. Such marks were recognizable for up to one year. After completion of the study these animals were released back in the field (Table 2).

Table 1
SIZE PARAMETERS OF LARGE-EARED HEDGEHOGS, *HEMIECHINUS AURITUS* GMELIN

	No. of animals	
Body length (mm)	12	220 + 12
Tail length (mm)	12	30 + 2
Foot length (mm)	12	45 + 2
Ear length (mm)	12	30 + 3
Body weight* (gm)	40	220 + 25

*Data on body weight included only wild trapped animals.

Table 2
THE TRAPPING SUCCESS OF HEDGEHOGS IN EACH MONTHS OF A CALENDAR YEAR

Months	Total No.	No. and percentage of animals trapped	Male	Female	Young
January	40	2, 5%	-	2	-
February	40	3, 7.5%	2	1	-
March	40	6, 15%	2	2	2
April	40	8, 20%	2	4	2
May	40	7, 17.5%	3	3	1
June	60	10, 16.6%	4	3	3
July	40	7, 17.5%	2	3	2
August	40	5, 12.5%	3	2	-
September	40	6, 15.0%	1	3	2
October	40	4, 10.0%	2	1	1
November	40	3, 7.5%	1	1	1
December	40	2, 5%	1	1	-

Results and Discussion

Present observations are based on the studies carried out in a terrarium, a seminatural device. Being nocturnal hedgehogs emerged at dusk and remained active for about 5 to 6 hrs and retired to their burrows at mid night. The little activity observed in the wild out side the burrow during the day was mainly that of 2-3 lactating females in months of April, May and June. It seems that the energy demands of the lactating females forced them to become active during the day. The nocturnal activity pattern was not affected by the presence or absence of moonlight.

The animals spent most of their time underground in small burrows invariably under a hedge or dense

bush, but never in open ground and loose soil. The burrows were simple and straight or L-shaped with single opening and were usually 60-90 cm in length. Only one individual occupied a burrow during February, except during breeding season (March to August) when the female lived with her offsprings. To accommodate the offsprings the female widened the blind distal end of the burrow. Animals tended to dig burrow at dusk or afterwards. Most of the burrow openings were on the slopes. In soft soil *Hemiechinus auritus* could dig about 10 cm in 5 minutes, in a manner similar to that reported in moles (Hisaw 1923) using their forelegs and hind legs.

There was a marked seasonality in trapping success. The peak was noticed in summer (April-July) while in winter months (December-February) the trapping success was least (Table 2). During May and early August most of the females were trapped with their litters. One female was accompanied with 4 to 6 young. The number of young trapped during different months of a calendar year is given in Table 2. The maximum body weight was in summer (March-July) and the minimum was in winter (December-January). The average difference in body weight of the animals between summer and winter was 12%. These differences were not found to be statistically significant (Student's 't' test, $P>0.01$), probably due to large variation between the individuals. The maximum body weight in summer is probably a reflection of greater food availability. The females lost much of their weight after parturition. The presence of a male reduced the weight of female in a captivity or under restriction of food. It seemed that male was dominant over the female in captivity (Personal observations, Unpublished).

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3. DO SHREWS PREY UPON RATS?

Grey musk shrews, *Suncus murinus* (L.) are often found in houses, poultry farms, grain stores, shops and fields in Asia and Europe. Grey musk shrews feed on household insects such as cockroaches and crickets, as well as on other invertebrates, small amphibians and reptiles (Annon. 1990). The range of this species is increasing. Prater (1980) has described grey musk shrews as "very intolerant of rats" and are believed to repel the rats by their strong and obnoxious body odour.

We captured one grey musk shrew in a multicatch rat trap (wonder traps, Jalgaon) on 3 December 1992 along the fields of Punjab Agricultural University, Ludhiana (30°56' N, 75°52' E and *c.* 247 m above MSL), India. This shrew had apparently consumed a gerbille, *Tatera indica* (Hardwicke) in the trap. From the size of the tail and other remaining parts the gerbille appeared to have been a juvenile.

This apparent case of predation by the shrew on the rat was in a confined condition. In natural conditions the shrews might prey upon young and weak rats. On many earlier occasions, we have trapped grey musk shrews in the multicatch rat traps but did not recover any rodent along with a shrew (unpublished data). We think, either the trapped rodents might have been consumed by the shrews or, probably, they avoided entering a trap that already contained a shrew.

We hypothesize that the strong smell of musk emitted by shrews might be responsible for repelling adult rats and enable shrews to capture inexperienced young and diseased ones. This predatory capability of musk shrews towards rodents and potential of their musk as a rodent repellent needs to be investigated.

November 8, 1993

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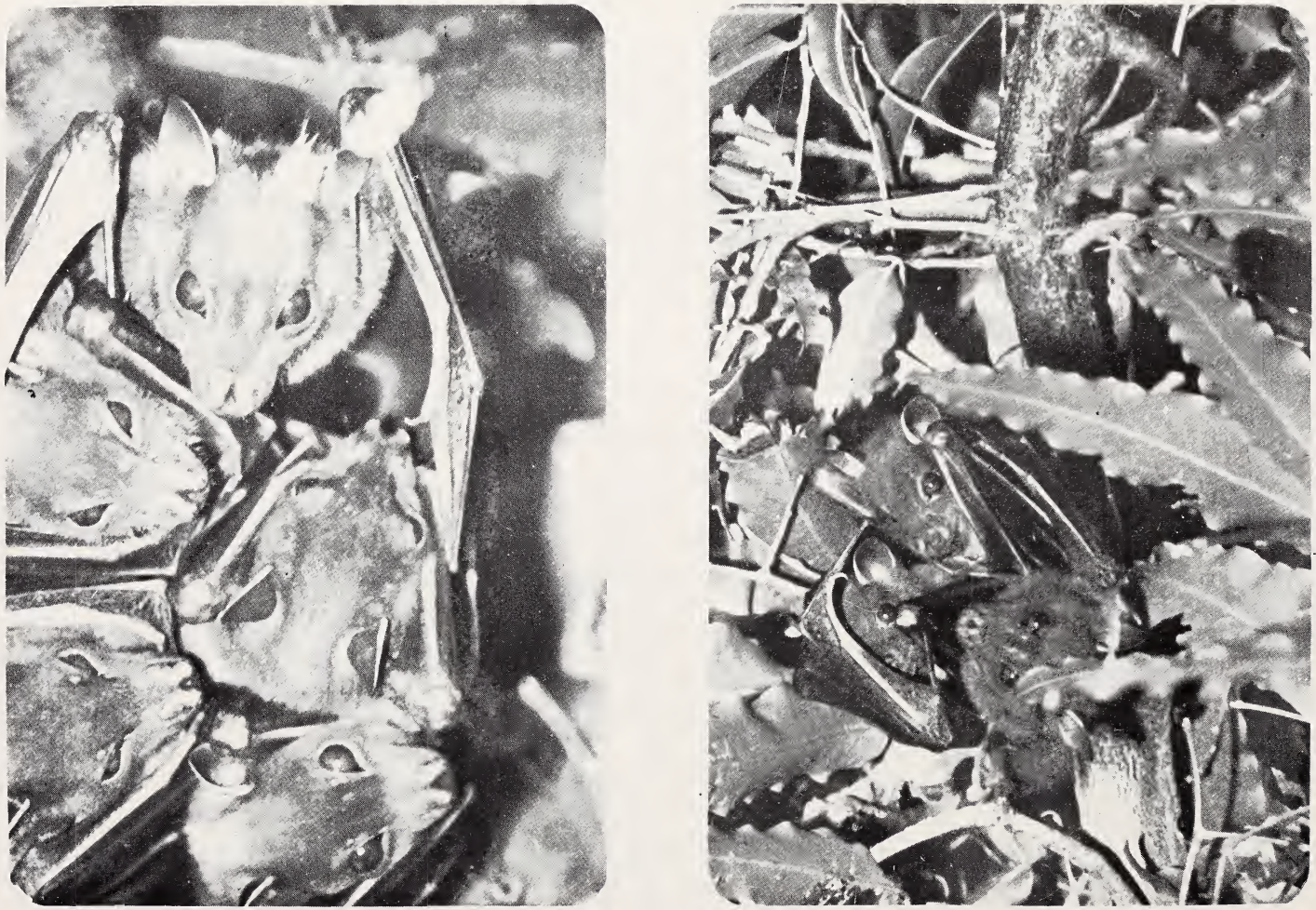

Indian short-nosed fruitbats clustered together forming a circle with their heads towards the centre of the circle.

4. AN UNUSUAL ROOST CHOICE BY THE INDIAN SHORT-NOSED FRUIT BAT, *CYNOPTERUS SPHINX GANGETICUS* (ANDERSON)

(*With a plate*)

Two sub-species of *Cynopterus sphinx* have been recognised by Hill (1983). These are *C.s. sphinx* (Vahl) and *C.s. gangeticus* (Anderson). Not only are there some morphological differences between these two sub-species (*C. s. sphinx* being much smaller in size than *C. s. gangeticus*), but they occur in different geographical localities. The former occurs in peninsular India while the latter in central and northern India. Both species are essentially arboreal, but there seems to be some difference between the two species regarding their adaptability to new roosting sites. *C.s. sphinx* has a variety of roosting sites such as 'tents' made among the dried drooping fronds, within the drooping clusters of strings of flowers and fruits of palm trees (Kitur palm) (Bhat and Kunz 1993), inside the foliage of creeper plants (Balasingh *et al.* 1993) and under the eaves of windows of large buildings. However, *C.s. gangeticus* does not normally roost anywhere except within the space amidst drooping dried fronds of palm trees in groups of 10 to 25 individuals. The bats fly away and take temporary refuge elsewhere only when the roost is disturbed.

Our attention was drawn to two groups of *C.s. gangeticus* roosting on the main stem of an Ashoka tree (*Saraca asoka*). One group had seven individuals and the other five. In both groups the bats were clustered closely together and were deposed in such a manner that they formed nearly a circle with their heads towards the center of the circle (Plate 1). The thick foliage of Ashoka tree hid them from all sides except from below, and hence they escaped being spotted by crows, kites etc. The fact that these groups were noticed in the same place for several days suggests that *C.s. gangeticus* adopts thickly foliaged Ashoka tree for new roosts occasionally. The close huddling of the bats in such a location is, probably, an adaptation to conserve heat.

The photographs were taken for us by Mr. Vilas Mangrulkar to whom we are thankful.

January 9, 1994

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5. NOTE ON THE BREEDING PERIOD OF PAINTED BAT (*KERIVOULA PICTA*)

Two live specimens of bright orange coloured bats were brought to the Kerala Forest Research Institute on August 26, 1993, for identification. The bats were captured locally from a banana plantation at Kannara, Trichur District, Kerala State. The bats were identified as *Kerivoula picta*, the painted bat. Roberts (1986) had reported this species as living among the dry leaves of *longan* tree (*Nephelium longana* — Sapindaceae). The present sighting of the bat among the dry leaves of banana and their resting posture merge very much with the environment of the bright yellowish and dry banana leaves. What is interesting is that the bat were a pair and the female had a small young one clinging on to its abdomen. Though this species is widespread in distribution, Prater (1965) recorded that there is no information on the breeding habits of the animal. Present observation of a mother with a young, gives some indication on the breeding period of the species.

December 20, 1993

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6. TOXICITY OF DIFETHIALONE (LM-2219) AGAINST *MERIONES HURRIANAE* UNDER NO-CHOICE FEEDING TEST

Introduction

Rodents are, by and large, the most destructive of vertebrates to agricultural production in India (Barnett and Prakash 1975). Their high adaptability has made it difficult to control their population. Anticoagulants are the primary means a control of rodents world wide (Marsh 1977, Brooks *et al.* 1980, Mukthabai *et al.* 1981).

A recently developed anticoagulant rodenticide, Difethialone was tested for its toxicity on the Indian desert gerbil, *Meriones hurrianae* (Jerdon). The chemical is a product patented by LIPHA of France.

Materials and Methods

Poison trials were conducted in the laboratory using the anticoagulant-Difethialone against *Meriones hurrianae*. Twelve individually caged rodents for each sex were tested. The poison bait of 0.00093 per cent concentration was prepared using Difethialone (liquid 1.25 gm/litre), Bajra flour, and 2 per cent sugar and 2 per cent groundnut oil as additives. Freshwater was given *ad libitum*.

Single day exposure was given with the above prepared bait. The remaining bait was weighed next day and computations done as in Table 1. Fresh rat feed was provided thereafter until death. The symptoms of Difethialone poisoning were recorded.

Results and Discussion

The results of the toxicity test (Table 1) indicate that Difethialone is a potent rodenticide against the Indian desert gerbil. The acceptability of the bait was good which shows cent per cent mortality in both the sexes. The anticoagulant is effective against the house rat, *Rattus rattus* (Arora *et al.* 1992).

The observations reveal that the mean days to death for the males (n=12) is 5.5 days and for females (n=12) 5.0 days. Evidently, the females were more susceptible.

The symptoms of poisoning include sluggishness. Traces of blood were observed in the nose and claws after 3rd day of poisoning. Subcutaneous hemorrhage was noted in the necropsied animals.

Table 1
EFFICACY OF DIFETHIALONE (0.00093%) BAIT AGAINST *MERIONES HURRIANAE* (JERDON) NO-CHOISE FEEDING TEST

Sex	Average body weight (gms)	Exposure period (hours)	Mean poison bait intake (gm/kg b.wt)	Mean active ingredient (mg/kg b.wt)	Mortality %	Days to death	
						Mean	Ranges
Male (n = 12)	95.0 ± 25.25	24	79.285 ± 9.37	0.71 ± 0.08	100	5.5	3-8
Female (n = 12)	72.5 ± 2.52	24	78.75 ± 4.13	0.70 ± 0.03	100	5.0	5

It is concluded from the above results that Difethialone is highly effective at 0.0093 per cent concentration against *M. hurrianae*. This is further confirmed by Lechevin (1987) who has reported its efficacy against two native field rodents of Europe (*Arvicola* sp. and *Pitymis* sp.)

Acknowledgements

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7. CROP PROTECTION FROM *BANDICOTA BENGALENSIS* BY THE TRIBALS IN SOUTHERN RAJASTHAN

Bandicota bengalensis is nocturnal and remains active throughout the night. Extensive damage is caused by them to the crop at various stages, right from the sowing stage. It takes heavy toll, specially of wheat crop in many localities in southern Rajasthan.

Bhils, the tribals of southern Rajasthan, check crop damaging activities of this rodent by a simple ingenuous method. Many 'rattlers', which are locally called 'Jalra' are erected at different points in the field, especially towards the periphery to frighten the night raiding bandicoots. A 'rattler' is prepared with locally available plant material. A bamboo pole about 2 to 3 metre in length is erected firmly in the field. Then a large sized teak (*Tectona grandis*) leaf is hung at upper end of the bamboo pole using a 0.50 to 0.80 m long peel strip, procured from leaf-rachis of a wild date palm (*Phoneix sylvestris*). After drying, the striated leaf strikes on the bamboo pole and produces a sort of rat-tat sound which is said to be effective to keep the nocturnal rodents away from the crop field. Besides this, the owls also use the bamboo pole-tips as a perch and help in rodent control.

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8. RODENT DAMAGE AND YIELD REDUCTION IN RICE

INTRODUCTION

Rice is the major crop in Bangladesh and is cultivated over 10.1 million ha and for this reason field research was initiated to evaluate the impact of rats on rice crops. The effects of various levels of rat damage on rice yields were examined by means of mechanically cutting stems. The principal rodent pests in Bangladesh rice fields are burrowing Muridae, primarily the lesser bandicoot rat; *Bandicota bengalensis* (Gray). In addition to what it consumes during the growing season, the rodents dig elaborate underground burrow system and store large amount of grains (Poche *et al.* 1982).

Swink *et al.* (1968) estimated 10% yield reduction in rice in the Philippines due to rat damage while Posamentier (1981) found 3.5% of damage of rice by the same species in Bangladesh. It has been calculated that at least 21 kg of food grain could be consumed by a rat annually (Husain and Siddiqi 1977).

The objectives of this study were to quantify the extent of rodent damage in rice (T. Aman, HYV), identify the rodent species causing most of the damage, and determine the effect of stem cutting on the yield. The stem is defined as that portion of the plant that gives rise to a panicle (i.e. seed head). Existing methods for damage assessments in rice are few; however, Posamentier (1981) examined rice losses in Bangladesh and Bindra and Sagar (1968) conducted similar studies in India.

MATERIAL AND METHODS

To determine the loss of rice by the field rats, experiments were conducted in villages Boyra, Achintapur and Kazirshimla of district Mymensingh. For rat damage assessment 360 plots, i.e. about 36.93 ha of agricultural lands were studied. To assess the yield reduction of crop ten plots were marked in the three study villages during the tilling, booting, dough and mature stages. Five steps along a diagonal line were paced off and a 100 x 50 cm wooden frame was used to sample the plants. Cut and uncut stems within the frame were counted and recorded. Data were analysed to determine per cent of crop damage using the formula of Posamentier (1984).

The effect of damage on yield was evaluated by cutting the normal mature stem on 10 m^2 quadrants spaced equidistant on the field diagonally. This process was repeated

in all the study villages. Panicles were threshed by hand, sun dried for 8 hours and weighed to the nearest g. To get the weight of grains per stem, the total weight of the grain was divided by the number of stems (Gomez 1972).

Results and Discussion

Destruction of tillers by rats during the vegetative stage of rice was slight in all areas sampled. The rat damage did not increase appreciably until about the booting stage and the maximum loss was experienced in the mature stage. The damage in the tillering stage of the crop was not more than 0.60% of all stems cut (Table 1). The effect of damage on yield showed that at the tillering stage cutting of stem had little impact on the yield because of compensatory growth of the stems.

Rat damage in rice was 2.32 per cent on an average in the study areas with the maximum in the mature stage (Table 1). In contrast to this, a total of 10% damage was assessed by Swink *et al.* (1968) while Srivastava and Pandey (1968) found a total 4.04% damage by field rats.

Once the soil became dry, *B. bengalensis* moved into the fields, established burrow system and began storing panicles. In general as the stem density in the field increased, rat damage also increased concomitantly. Damage was severe in the immediate proximity of the burrow openings. Brooks *et al.* (1982) and Poche *et al.* (1982) found similar results in their studies.

At the tillering stage of rice the yield reduction of grain was 9.91 kg/ha corresponding to the per cent damage of 0.50% of stem. This per cent reduction increased to 2.15% at the booting stage and the yield reduction of grains was 54.25 kg/ha. During the dough stage the average grain loss was 34.42 kg/ha accounting for a total damage of 1.23% of stem. This extent increased at the mature stage and the loss of stem was 5.41%. The average grain loss of this stage was 121.93 kg/ha. The average loss of grain in all the study villages was 55.13 kg/ha. The highest yield reduction was at Boyra than at Achintapur and Kazirshimla (Table 1). Analysis of variance resulted significant F ($P<0.01$) and DMRT revealed that grain reduction of rice caused at mature stage was the highest ($P<0.01$).

The study showed that the maximum number of *B. bengalensis* was trapped during the months of November and December, i.e. the harvesting period of T. Aman. Other rodents, particularly *Rattus rattus*, *Mus booduga* and *B. indica* were found in low proportion.

Table 1
RAT DAMAGE ASSESSMENT IN RICE FIELDS (T. AMAN, HYV) AT DIFFERENT GROWTH STAGES

Stages	Villages	No. of tillers/ha		% of tiller damaged	Area studied (ha)	Grain loss (kg/ha)
		Uncut	Cut			
Tillering	Boyra	2532700	10700	0.40	2.51	10.16
	Achintapur	1888700	10700	0.60	5.50	10.27
	Kazirshimla	1973700	9600	0.50	2.85	9.31
Booting	Boyra	2724000	55900	2.02	2.66	53.10
	Achintapur	2560600	81700	3.10	4.30	78.43
	Kazirshmila	2396100	32200	1.32	3.65	31.23
Dough	Boyra	3143300	31100	0.98	1.24	29.54
	Achintapur	3646400	25800	0.71	0.75	24.76
	Kazirshmila	2516500	50500	1.99	2.74	48.98
Mature	Boyra	2420900	159100	6.91	3.12	151.14
	Achintapur	2333800	131100	5.32	3.86	125.85
	Kazirshimla	2234900	93500	4.01	4.01	88.82
4-Stage $\overline{X}$				2. 32		55.13

Acknowledgements

I thank Professor Kazi Zaker Husain, Department of Zoology, University of Dhaka for his suggestions during the research work. He is also grateful to Professor Mosharraf Hossain, Department of Entomology, Bangladesh Agricultural Unviersity, Mymensingh for critical revision of the manuscript. I am indebted to Bangladesh University Grants Commission for financial assistance.

November 10, 1993

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9. A NOTE ON NEST BUILDING, BEHAVIOUR OF WILD BOAR (*SUS SCROFA* LINNAEUS)

Among the two members of the family Suidae, the wild pig (*Sus scrofa*) is the only representative from South India. Prater (1980 THE BOOK OF INDIAN ANIMALS) reported the nest building behaviour of wild pig as follows: "the mother shelters them in a heaped-up mass of grass or branches which she builds before she litters". During the field studies in Parambikulam Wildlife Sanctuary, while searching for indirect evidences of wild animals in a three year old teak (*Tectona gradis*) plantation near Anappady, construction of an abandoned nest built by a wild pig was studied.

The nest was built at the centre of a teak plantation of about 5 ha in area. The whole plantation was covered by the weed *Chromolena odorata* growing more than 2 m in height. The basal portion of the nest was lined with uprooted grass to a height of 10-15 cm. Along with this, eight pieces of teak branches and some *Chromolena odorata* twigs of one metre length were also found in the basal portion. The nest had an area of 2 m in diametre. The entrance to the nest was in the form of a tunnel of one metre height. The middle portion of the nest had a depression to the extent of 75 cm diametre and depth of 20 cm. The nest was positioned in between two live three year old teak saplings.

Even after elaborate search, no other nest was found in the teak plantation. Water was available within a distance of 200 m from the nest.

March 24, 1994

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10. ON THE RECOVERY OF A FOETUS FROM A SPERM WHALE *PHYSETER MACROCEPHALUS* LINNAEUS STRANDED AT CHETLAT ISLAND, LAKSHADWEEP

Though James and Panicker (1990) listed the strandings of the sperm whale 17 times from the Indian Seas no foetus was found in any of them. Usually sperm whales stranded are cut open to see whether any ambergris is present. This is the first time that a foetus was found in the body of a sperm whale stranded from the Indian Seas.

On 15-8-1990 a female specimen of 9.5 m length with body girth of 12 m was stranded at the Southern extremity of Chetlat Island in the Lakshadweep group of Islands. Earlier sperm whales have been stranded thrice at Chetlat Island (James and Panicker, op. cit.). The foetus was a female measuring 3.5 m in length and 2.3 m in girth and was laying in an obnormal position inside the uterus and this could have probably caused the death and subsequent stranding of the whale.

According to Berzin (1972) calving is almost round the year in sperm whale and the gestation period is 11-12 months. The largest embryos varied in length from 4.6 to 6.0 m and the smallest sucklings varied in length from 3.7 to 5.6 m. Average length at the time of birth is 4.0 to 4.2 m. Judging from the size of the present foetus we can say that it was near time.

We are most grateful to Dr. P.S.B.R. James, Director, Central Marine Fisheries Research Institute, Kochi for his kind interest and encouragment.

April 18, 1994

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11. FIRST RECORD OF THE ROSY PELICAN *PELECANUS ONOCROTALUS* LINNAEUS IN KERALA

The Rosy Pelican *Pelecanus onocrotalus* Linnaeus is recorded as a common winter visitor to Pakistan and North India, from Punjab to Assam, Andhra Pradesh and Madras. But, so far there is no record of this species from Kerala.

In the course of our routine field observation at Vellimukkuchali, a swampy area in Tirur taluk, Malappuram district, Kerala, on the morning of 18th December 1992 we noted eight birds floating in water. At first sight itself it was very much evident that they were pelicans. Since we have had field guides with us we identified them as Rosy Pelicans. Rose tinged white colour, long characteristic beak and marginal black feathers (primaries and secondaries) in the wings showed that Kerala got an addition to its list of birds. We observed them for about two hours. After two hours they flew upward, made 3-4 rounds there and slowly flew away from our sight. The locals told us that the pelicans had arrived in the early morning that day.

After a few days we received information on the sighting of the same species from Arkulum lake, Trivandrum.

Recently, Kerala is being revisited by hitherto unrecorded birds. For example, we observed and photographed the Flamingos last year on 9th January 1991 at Ponnani.

February 5, 1993

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12. ROSY PELICANS *PELECANUS ONOCROTALUS* LINN., IN THE HIMALAYA

In May of 1992 I was resting at over 3050 m on the Patalsu mountain which is a 4250 m fermination of a spur south of the prominent Sheeti Dhar range at the head of the Beas Valley separating the southern valleys of Kulu from the arid trans montane regions of Lahaul and Ladakh beyond.

It was a brilliant morning and updrafts had just started with the first clouds forming above each column of rising air. A wonderful day for large gliding birds like vultures, lammergeyers, eagles and storks and pelicans. Just as I thought of pelicans, I saw a tight group of eleven white birds which indeed were Rosy Pelicans! I must have watched them circling and going higher and higher for full fifteen minutes till, as mere specks they flew west parallel to the mountain range.

This is perhaps what they normally do in their migration from the plains of India towards Central Asia. For great gliders like the Pelicans the snow range is in striking distance from the lowlands and the series of updrafts along the western flanks of the Dhauladhar Range overlooking Kangra and Punjat convenient for covering immense distances. As far as I know there are no records of Pelicans migrating across Tibet.

November 3, 1993

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13. SOUTHERNMOST RECORD OF COMMON POCHARD *AYTHYA FERINA* (LINNAEUS) AND TUFTED DUCK *AYTHYA FULIGULA* (LINNAEUS) IN MADURAI DISTRICT, TAMIL NADU

While conducting midwinter waterfowl counts during 1990 and 1991 Common Pochard *Aythya ferina* and Tufted Duck *Aythya fuligula* were sighted on three irrigation tanks. During 1990 the birds were sighted on Vellari Kanmai tank, about 20 km from Madurai and Urappanur Tank, a few kilometres south of Madurai. During 1991 about 400 Common Pochards were sighted in Kunnatur irrigation tank, east of Madurai.

Madurai is out of the known range of both the species. According to Ali and Ripley (1983) the species is seen decreasingly southward in the peninsula, irregularly to Karnataka and not recorded further south. Their southernmost record is from Pondicherry (Perennou 1989). The Tufted Duck was recorded as occurring in Madurai District (Nichols 1945) but there does not seem to be any record after that.

This is possibly the southernmost record of Common Pochard and the second record of the occurrence of Tufted Pochard after 45 years in its southern most range.

May 28, 1994 T. BADRI NARAYANAN

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14. RARE CRANE OF INDIA

On 2nd of December 1992 while entering within the Bhutanghat Forests of the core area of Buxa Tiger Reserve a pair of Blacknecked crane *Grus nigricollis* Przevalski was sighted, on a freshly harvested paddy field.

This large crane having a black neck, and a milky white body, breeds in Ladakh. The reports of the wintering of these cranes were so far known only from the upper reaches of Bhutan and the hills of Arunachal Pradesh not below 2000 m altitude. The pair sighted in Mainabari Beat of Buxa Tiger reserve near Bhutanghat Forest is more or less a Bhabar tract having an altitude of 200 m. only.

The Director of the International Crane Foundation, George Archibald has confirmed that the photograph of the crane taken within Buxa Tiger Reserve as of the Blacknecked Crane and stated that it as an extremely unusual drop in the wintering habits for the species to be found in the Indian plains. Interestingly enough the local villagers confirmed its arrival every year during this period and the Wild Life Conservator Shri M.K. Nandi, has also confirmed sighting of this species at Chapramari sanctuary of West Bengal which again is a bhabar area.

This first report of a Blacknecked Crane in West Bengal; as well as from any place at such low altitude during the winter season is noteworthy. Let us hope for sighting this bird every year in Buxa Tiger Reserve.

April 10, 1993 P. SANYAL

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15. COMMENTS ON THE NOTE OCCURRENCE OF BLACK TERN *CHLIDONIAS NIGER* (LINNAEUS) AT POINT CALIMERE BY VIVEK MENON

The occurrence of black tern *Chlidonias niger* at Point Calimere was earlier reported by Abdulali and Ambedkar (1983) and Natarajan and Balasubramanian (1990). Its further occurrence at Point Calimere had been confirmed under the Bird Migration studies conducted by the Bombay Natural History Society (BNHS) by ringing 48 individuals of the same species by me between 1989-1991. Also 17 individuals were ringed at Kaliveli Lake and one from

TABLE 1
MEASUREMENTS OF *CHLIDONIAS NIGER*

Wing	Bill (from feather)	Tarus	Tail		Fork	n
			Outer	Central		
201-226	25-30	15-18	69 (Cramp 1985)	57	10-16	38
205-210	23-26	-	70-76 (Natarajan & Balasubramanian 1990)	64-66	6-10	3
194-222	23-27	17-22	62-82 (Balachandran, unpubl.)	-	-	48
202	28.5	17	(Mohapatra, unpubl.)		-	1
257	40	19	107	63	44	1

Pulicat Lake. As there is no specimen at the BNHS, the measurements of the species is not given in the HANDBOOK. However, the biometrics of three individuals ringed by Natarajan and Balasubramanian is the only available measurements for this species from India which fall within the range of the measurements given by Cramp (1985) with slight variation in tarsus length (Table 1). The measurements obtained from the remaining individuals tallies with the measurements of Cramp (loc. cit.) with slight variations. These slight variations may be due to the differences in the measurements of the museum and live specimens. But the measurements given by Vivek Menon is no way in the close ranges of this species, except the tarsus. For example wing, bill, and tail measurements exceeded the maximum ranges by 31 mm, 10 mm and 28 mm respectively. The fork (the difference between T1 (63) and T6 (107) is 44 mm, which is also too much for this species, as this species has almost a squarish tail with the maximum fork length of 16 mm. From the measurements the species mentioned in the note (JBNHS Vol. 89(1): 120) is not the black tern but probably a common tern *Sterna hirundo*.

January 6, 1993

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16. FOREST EAGLE OWL (*BUBO NIPALENSIS* HODGSON) — A PREDATOR OF THE INDIAN GIANT SQUIRREL (*RATUFA INDICA*)

On 29 October 1992, at about 9.30 a.m., I was conducting a routine bird census along the trail across the evergreen Forests of Karian Shola National Park (10°28'N; 76°50'E) near Top Slip, Tamil Nadu. Hearing a commotion ahead, I saw a Forest Eagle Owl flying across the trail a little distance from me, and alighting on a small tree. Dangling from its talons was the partially eaten carcass of an Indian Giant Squirrel. For nearly five minutes the owl remained perched there ignoring the ceaseless agitations by the many bulbuls and drongos around. Eventually the owl saw me and flew away deeper into the Forest, leaving the prey hanging on the limb. A couple of days later, the carcass was still there.

The Forest Eagle Owl is an efficient predator against a variety of forest dwelling small to medium sized animals, a list of which is given by Ali and Ripley (1987). Since the Giant Squirrel does not feature in this list, and considering the endangered status of these squirrels, I decided that this rarely seen incident was worthy of recording. Incidentally, Borges (1986) reports a predation attempt on this squirrel by the Black Eagle (*Ictinaetus malayensis*) a raptor which is seen regularly at the Karian Shola National Park.

January 10, 1993

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17. NOTES ON THE STATUS AND ECOLOGY OF THE CEYLON FROGMOUTH (*BATRACHOSTOMUS MONILIGER* BLYTH) FROM THE ANAIMALAI HILLS OF TAMIL NADU

The status of the Ceylon Fromouth *Batrachostomus moniliger* was little known and was a cause for concern until the publication of Sugathan's (1981, JBNHS 78: 309-316) in which he revealed that the bird exists in reasonable numbers in the state of Kerala. His surveys did not, however, cover the adjacent hill forests of Western Tamil Nadu from where no published information on the bird exists. This note throws light on its occurrence in Tamil Nadu and its status in the Anaimalai hills. Anecdotal information on the birds' habits and habitat are also given.

During 22 months of intensive field-work in the forests of Topslip (10°28' N; 76°51' E), seven birds were encountered

by chance in the following three different localities. All these sites lie within the Indira Gandhi Wildlife Sanctuary.

1. Karian Shola, 1 km from Topslip; Three birds (2 adults, 1 young). Seen regularly at roost between December 1991 and February 1993.

2. Varagaliar Shola, 24 km from Topslip: A pair, seen on 19 December 1992.

3. Seechali, *c.* 10 km from Topslip: A pair seen on 8 October 1992.

These three areas are just between 0.2 to 2 km east of the Kerala border. The birds were seen in two very different habitats, i.e. evergreen forest undergrowth and dense bamboo jungle, adding support to Sugathan's finding that their habitat choice is varied. The evergreen forest area is represented by tree species such as *Carallia*, *Polyalthia*, *Mesua*, *Myristica*, *Alseodaphne* and *Garcinia*. The bamboo forest is almost exclusively bamboo, but for occasional lofty trees like *Terminalia*, *Pterocarpus* and *Bombax*. This Catholic nature of the Frogmouth's habitat choice makes them less vulnerable to local extinction. This leaves room for optimism that the birds are less-specialised than once believed and may survive even in areas where the evergreen forests have been damaged.

The Karian Shola birds were first seen at their roost on 29 December 1991 as a pair. This pair roosted in the same general area, (albeit with some brief disappearances), and mostly on the very same perch, until February of 1993, i.e. a period of 14 months. The pair appeared with a young bird in November 1992, which stayed with the parents for 2 months, till January 1993. The young bird would roost huddled and sandwiched between the parents. On one occasion, however, the young was seen roosting in a small plant some distance away.

The roosting birds were perched between *c.* 2 to 4 m above the ground. They would flush only when almost stumbled upon. They appeared very tame, allowing close approach, and seemed unperturbed by camera bulbs going off close by. When approached too closely, i.e. within a metre so, the birds would open their mouth wide revealing the extraordinarily large gape and the small grey flap of a tongue. Evidently this is a threat gesture, hitherto unreported by other observers.

The fact that seven of these cryptic, hard-to-find birds were recorded without actually searching for them, may mean that the bird may be much more common than is apparent. Sugathan (1981) also came to a similar conclusion after his extensive survey in Kerala.

These notes on the ceylon Frogmouths' habits, site-fidelity and parental care, although anecdotal, represent some of the first known information on this enigmatic bird. The Topslip area, with its convenient logistics, terrain and Frogmouth population, may be an ideal place to conduct a more detailed investigation of this species.

I thank my tribal guide Natarajan, but for whose "Frogmouth-eye" this note would never have materialised.

April 25, 1993

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18. AN ALBINO MYNA *ACRIDOTHERES TRISTIS* (LINNAEUS)

On 18th September, 1992, I was going from Malda to Raiganj. These two are well known towns of West Bengal. While I was in the midst of Itahar and Raiganj our car stopped near Durgapur (a village of the district Uttar Dinajpur). I observed there a white Myna walking and feeding on the insects and food grains near the road side accompanied by three normal coloured common mynas (*Acridotheres tristis*). The albino was dusty white but the head was chocolate brown. Two brown stripes on each wing and on tail was clearly visible during flight. The colour of the legs and cheek was pinkish instead of yellow but the colour of the bill was yellowish. I had no doubt that the bird was a common myna (*Acridotheres tristis*) and albino one due to lack of pigmentation. Its walking style and call was same as common myna's. Before I could get some more details the bird flew away with its three companions. I have never heard or seen albinism in common myna.

February 23, 1993

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19. DISPERSED COMMUNAL ROOSTING IN COMMON MYNAS *ACRIDOTHERES TRISTIS* (LINNAEUS)

Common Mynas *Acridotheres tristis* roost at night in large noisy assemblages in trees (Sengupta 1982). In these roosts, song can continue late into the evening and disturbances can lead to renewed singing throughout the night. In Singapore, this leads urban myna roosts to be regarded as troublesome on account of the noise (Hails 1985). Prior to entering the roost site, Common Mynas gather in pre-roost assemblies in open areas or on

buildings. Although this behaviour is the norm for Common Mynas (Ali and Ripley 1972, Sengupta 1982), and occurs on the main islands of the Seychelles (Greig-Smith 1982), Feare (1976a) recorded an instance on Bird Island (70 ha) Seychelles, where they did not roost communally at night.

During a study of Common Mynas on Fregate Island (1200 ha), Seychelles, between 31 January and 12 February 1992, we found that these birds failed to form a large and noisy communal roost and here describe an hitherto unrecorded type of night time roosting for this species.

Fregate Island is roughly ovoid and hilly but on the north-east coast is a plateau of about 10 ha. The coastal fringe of the plateau is a grass airstrip while the inland part is the main area of cultivation on the island. The Fregate Island myna population comprises about 300 birds (Feare and Allan unpublished). During this study, observations of nest-building and examination of the gonads of a small sample of birds suggested that breeding was about to commence. Singing birds, all apparently paired and attending nest cavities, were widely distributed over the island during the day but the highest density was on the north-east plateau. Some mynas roosted in tree cavities at night but in the late afternoon and evening many were seen flying from all parts of the island to the north-east plateau and were seen returning to their nest sites shortly after dawn.

During the afternoon mynas gathered on the airstrip, especially on windless days when insects were abundant there. Up to 180 mynas were recorded on the airstrip, suggesting that most of the island's population gathered there in a pre-roost assembly. They fed and also displayed, with members of pairs bowing and giving short bouts of song, and pairs also indulged in chases.

At dusk, mynas flew into the crowns of coconut *Cocos nucifera* trees on the inland part of the plateau. By 1845 h the birds had moved deep into the crowns among the fruits and were not visible, and by 1900 h the roosting birds were silent. However, only 2-4 birds flew into each tree so that the entire roost was dispersed over 3-4 ha of the coconut plantation. This dispersed and comparatively silent roosting has not previously been described and contrasts with this species' more usual roosting behaviour.

The reasons for this dispersed system of roosting on Fregate Island are not clear but we suggest three possibilities: a lack of predators, reduced need for information on food availability, and a response to large numbers of roosting seabirds.

Fregate Island has no avian predators (apart from scarce palaearctic migrant raptors) and the only terrestrial predators, two species of snake, are unlikely to be able to take full grown mynas. If predation is a factor that promotes dense communal roosting (Eiserer 1984), the absence of predators on Fregate Island could allow the more dispersed roosting system observed, assuming that there were other advantages in dispersal or disadvantages in dense aggregation.

On small oceanic islands, the daily movements of mynas could be such that each bird could survey the food resources over much of the island. For example, Kang (1992) found that radio-tagged Common Mynas in Singapore ranged over about 0.25 sq.km, while on fregate Island our observations showed that birds from most of the island flew to the pre-roost assembly on the airstrip. Under these circumstances, mynas may not need information about food distribution which Ward and Zahavi (1973) considered to be available through communal roosting. The mechanism of presumed information transfer in roosts is not known, however, and some information might still be available in dispersed roosts.

Finally, the dispersed roosting may be a means of avoiding the large numbers of seabirds, mainly White Terns *Gygis alba* and Black Noddies *Anous tenuirostris*, that also roosted at night (and for much of the day) on Fregate Island. Avoidance of seabirds could be advantageous for two reasons. First, roosting seabirds produce large quantities of droppings which can impair the plumage quality of birds whose feathers become soiled (Yom-Tov 1979). Second, seabird assemblages can be sources of heavy ectoparasite infestations which can adversely affect avian hosts (Feare 1976b). On Fregate Island, however, mynas could avoid seabirds by roosting further inland away from the coastal plateau, where seabirds roost at lower density.

None of the above explanations is entirely satisfactory in explaining the dispersed roosting of Common Mynas on Fregate Island. However, these observations, and those on the absence of communal roosting on Bird Island (Feare 1976a), suggest that Common Mynas exhibit some flexibility in their roosting behaviour and that studies of this species could be instructive in elucidating the advantages of communal roosting behaviour. Common Mynas have been introduced to many oceanic islands (Lever 1987) and studies on islands of different sizes, predator pressures, food availabilities and distributions, and climates might indicate correlates of different roosting tactics.

December 23, 1992

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20. FLYCATCHING BY SUNBIRDS *NECTARINIA ASIATICA* (LATHAM)

I happened to spend a week at Vazhachal R.F. (Trissur District, Kerala) and was able to observe a rather remarkable behaviour among sunbirds. The immediate environs of our quarters were mostly teak plantations, highly degraded secondary forest and a small riparian patch fringing the river. Here by the river side stood a large *Xylia xylocarpa* tree, the canopy of which was more or less completely draped with a climber (species unidentified) in bloom. The blossoms attracted large numbers of insects. Four Purple sunbirds (*Nectarinia asiatica*) — three males in eclipse plumage and a solitary female were seen on the tree. Every few seconds one of them would launch an aerial sally, catch an insect and return to its perch. The method of capture was exactly in the typical flycatcher and the sunbirds seemed as adept and dexterous as flycatchers. Some insects were pursued for considerable distances before they were captured. Close scrutiny through binoculars revealed that the sunbirds had a high percentage of success.

I was able to observe this interesting behaviour on three consecutive days, namely 28-12-93, 29-12-93 and 30-12-93. All three occasions were on mornings at about 7 a.m. to 8 a.m. Frequently a pair of loten's sunbird (*Nectarinia lotenia*) and a few Purple rumped sunbirds (*Nectarinia zeylonica*) also joined the flycatching. Once I counted 11 sunbirds of the three species sallying for insects. While the loten's runbird and Purple rumped sunbird left after a few minutes, the four Purple sunbirds stayed on assiduously intent on capturing insects. The birds were very vocal chittering excitedly. Rarely one bird chased away another, but otherwise no aggressive behaviour was observed.

According to the HANDBOOK, Purple sunbirds do indulge in flycatching, but nothing is said regarding this habit of either loten's or Purple rumped sunbird. At Vazhachal I could observe all three species actively engaged in flycatching. It was strange that not even once were they observed probing the flowers of the creeper for nectar, a favourite food of sunbirds.

May 28, 1994

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21. NOTES ON FEEDING HABITS AND SOME MORPHOLOGICAL FEATURES OF THE BOSTAMI TURTLE, *ASPIDERETES NIGRICANS* (ANDERSON)

(With a text-figure)

INTRODUCTION

Aspideretes nigricans (Anderson), locally called 'gazari', 'madari' or Bayazid Bostameer kachim (kachim = turtle) after the Mohammedan shrine of Sultan al-Arefin Hazrat Bayazid Bistami (locally pronounced Bostami) is endemic to Bangladesh. Little is known about this species (see Khan 1980, 1982;

TABLE 1
ECONOMICS INVOLVED IN THE FEEDING OF THE BOSTAMI TURTLE

	Bread (kg.)		Banana (no.)		Offal (kg.) offered/	Total cost	
	sold	eaten	sold	eaten	eaten	sold	eaten
Daily sale (± SD)	65 ± 47	24	1032 ± 313	271	0.63	-	-
Price (in Taka)	497	84	341	89	11.71	850	287
(in US $)	17	6	11	3	0.39	28	9
Yearly sale (± SD)	23,531	8,783	376,680	98,915	330.00	-	-
Price (in Taka)	181,405	67,708	124,304	32,642	5,610.00	311,319	105,960
(in US $)	6,047	2,257	4,143	1,008	187.00	10,377	3,532

Ahsan and Haque 1987, Ahsan *et al.* 1991, Ahsan and Saeed 1989, 1992). This paper deals with food habits and feeding behaviour and economics of the species and describes some morphological features.

STUDY AREA AND METHODS

The species is restricted to a pond attached to a shrine situated about 6.5 km to the north-west of Chittagong town (22°11' N and 91°09' E). The study was carried out between January and July 1984. The food habits and feeding behaviour were observed from the main platform of the pond. Feeding was defined when an individual was actually seen swallowing a food item. The time spent in major activities (feeding, resting, floating and moving) were noted for all focal animals. Feeding was noted for all focal animals (males and females separately) at intervals of 5 minute scan samples. Each animal in each scan was considered as one observation. Data were collected for 2 to 3 days a week from 0700 to 1800 hours randomly and only feeding is described in this paper. Food assessment was done from the data collected by personal communication with the local shops. Some of the offal (mainly cattle lung), fed to the turtles, is brought from outside the shrine area. Hence the quantity fed has been estimated from visual observations. To find out their food preference we offered bread, banana, offal, puffed rice, cooked rice, and 'chapati' to the turtles and observed that all the food offered at a time to the turtles were not eaten except for offal.

Morphological features have been described from live specimens observed in the pond. Osteological features were studied from carapace, plastron and skulls collected from the turtle burial ground on the bank of the Bayazid Bostami pond. Skeletal material has been deposited at the Museum of the Zoology Department, Chittagong University.

RESULTS

Food Habits and Feeding Behaviour: The Bostami turtles are dependant on food supplied by visitors and pilgrims. The main food consists of bread, banana and offal; but puffed rice, chapati, and cooked rice and meat, are also occasionally offered. The turtles have no scheduled feeding time, but spend more time feeding in the mid-and late morning and afternoon. Thus they spend most of the day alternately feeding and resting above or under water.

Proportion of time spent feeding: Of 15,933 observations (1,938 for feeding) during 633 scanning over 61 hours in 22 days, the turtle spent 12.2% of day time in feeding. The food involved in 37.4% of this time was bread, 26.3% on banana and 36.4% on offal.

Male and female turtles spent 65.2% and 34.8%, 59.4% and 40.6% and 63.8% and 36.4% of time eating bread, banana, and offal respectively. It thus appears that males spend more time feeding than females.

Economics of feeding: From the average amount of bread and banana sold daily from the 11 shops during January to July 1984, we estimated the yearly sale and cost (Table 1). The annual expenditure on food, including offal which are brought from outside, for the Bostami turtle is about Taka 3,11,153 (= US $ 10,372) (Table 1). The amount of food eaten, especially bread and banana, by the turtles was nearly the same as the amount of time they spent feeding and therefore, their cost was also estimated (Table 1). On the yearly 'oros' (death anniversary of the saint), 10-15 cattle are slaughtered and their offal are offered to the turtles, the meat being eaten by the pilgrims, but these have been excluded from the above estimate.

Morphology of *Aspideretes nigricans*: Meylan (1987) has described the osteology of the species. What follows is a description of gross morphology. An ovipositing female was considered to be adult. Specimens

TABLE 2
MEASUREMENTS OF THE BOSTAMI TURTLE

Parameters (cm)	Adult male	Adult female
Curved width of carapace	52.85 ± 9.08	44.50 ± 11.05
Straight width of carapace	42.65 ± 8.27	34.64 ± 6.53
Shell height	12.28 ± 2.48	7.80 ± 1.03 (nesting)
Straight length	54.89 ± 9.05	37.70 ± 4.08 (nesting)
Shell height	-	14.90 ± 2.47 (Non-nesting)
Straight length	-	60.25 ± 5.74 (Non-nesting)
Distance between hind limb	17.37 ± 3.93	14.45 ± 2.61 (Nesting)
	-	23.95 ± 2.11 (Non-nesting)
Maximum length of carapace	78	74
Maximum width of carapace	66	68
Maximum wet body weight (kg)	54	50

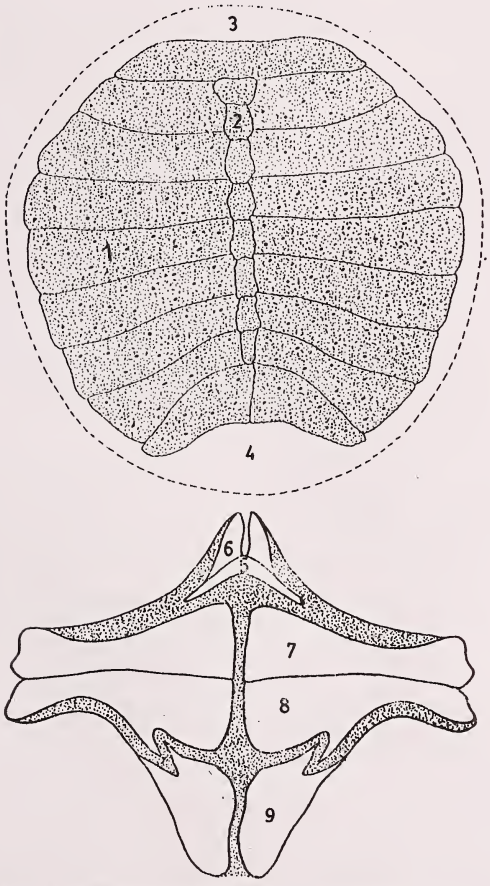

Fig. 1a. Carapace and plastron of *Aspideretes nigricans*
1. Costal; 2. Neural; 3. Nuchal; 4. Pygal; 5. Entoplastron; 6. Epiplastron; 7. Hyoplastron; 8. Hypoplastron; 9. Xiphiplastron

much smaller in body size than ovipositing adults were regarded as juveniles. At the caudal extremity of the carapace, the cartilaginous flap is much extended. The carapace is covered with soft skin. The carapace and plastron are connected by cartilaginous plates. Irrespective of sex (n=100), the minimum and maximum values of curved carapace length and width recorded were 39 and 78 cm (mean 62 ± 10.16), and 33 and 71 cm (mean 53.27 ± 9.27) respectively (Ahsan and Saeed 1989). Generally males are larger than females. Adult males and adult females can be differentiated by the following characters (mainly based on Ahsan and Saeed 1989): (1) Tail of females shorter than that of males, the female cloaca not protruding outside the carapace. (2) Carapace of females more rounded than that of males (see Table 2). (3) Males shell height is larger and smaller respectively than that of ovulating and non-ovulating females[1] (see Table 2). (4) Mature males are larger and heavier than mature females[2] (see Table 2). In the larger specimens a deep longitudinal groove is found in the middle of the carapace (common in large trionychids).

Osteological Features: Carapace Plastron and Skull (Fig. 1a and 1b): The carapace consists of eight pairs of costals plates. Among these, the last one is most developed and in contact throughout the median line. There are two neurals between the first pair of costals. The entire carapace is coarse and vermiculated. There are eight neurals in the middle of the costals. The 8th pair of costals touch each other and are connected with the pygal plate. Neurals broad on the cranial side and

[1] For measurements given in items 3 and 4, ten specimens each of ovulating and non-ovulating females, and males were randomly chosen.

[2] Measurements after Ahsan and Saeed 1989.

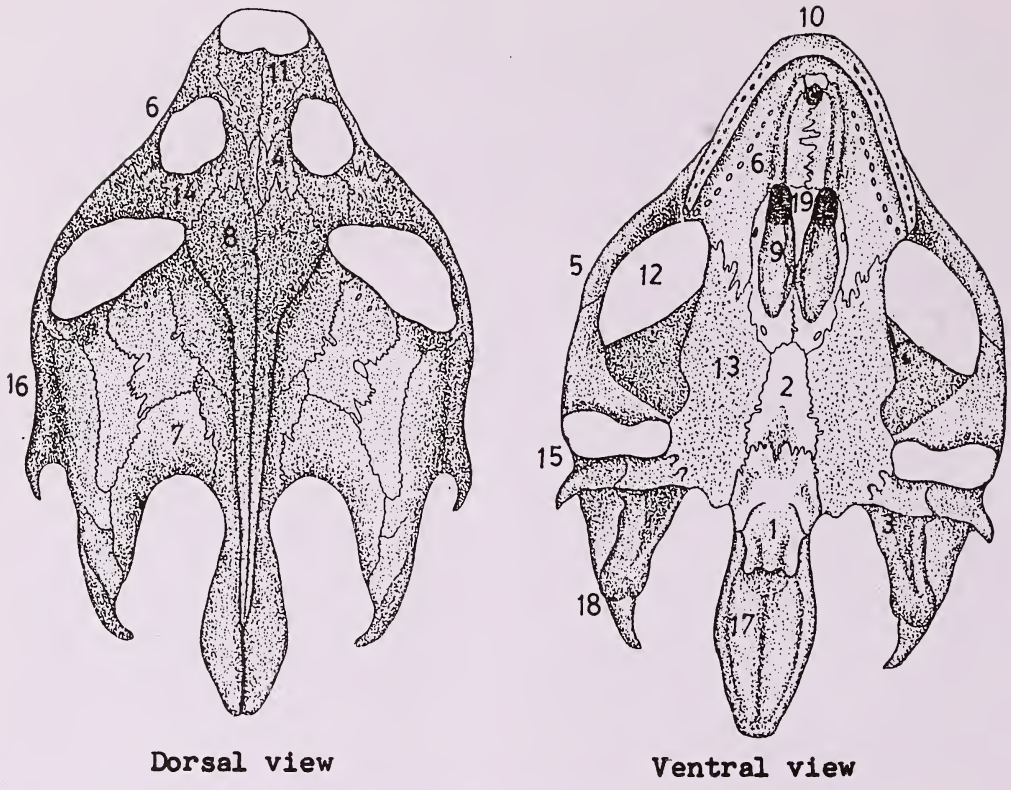

Fig. 1b: Skull of *Aspideretes nigricans*
1. Basioccipital; 2. Basiphenoid; 3. Exoccipital; 4. Frontal; 5. Jugal; 6. Maxillary; 7. Opisthotic; 8. Parietal; 9. Palatine; 10. Praemaxillary; 11. Praefrontal; 12. Prootic; 13. Pterygoid; 14. Postfrontal; 15. Quadrate; 16. Quadrato jugal; 17. Supraoccipital; 18. Squamosal; 19. Vomer.

become narrower caudally around the costals. The plastron is very large and more or less cross-shaped. Both cranial and caudal sides are blunt and parallel vertebrally. Epiplastra narrowly separated from each other in front of entoplastron. Hyoplastron and hypoplastron connected with each other looking like a single bone. Rostrum of the skull is a little longer than the diameter of the orbit.The inter-orbital region in the adult is as broad as the nasal fossa. The post-orbital arch is one half or less than the diameter of the orbit. The alveolar surface of the upper jaw is flat, with a well-defined median (maxillary) groove between them.

Discussion

Food (bread, banana, offal, puffed-rice, etc.) is brought daily by the visitors and pilgrims to the shrine and offered to the turtles from dawn to dusk. The proportion of time spent in feeding is not constant throughout the year, varying daily, depending on the number of visitors that offer food.

The Bostami turtle prefer lung and/or other offal to items like bread, banana and puffed-rice. Turtles were recorded swallowing 25-30 medium sized pieces of lung (about 120 gm) within 10 mintues.

It may be mentioned here that hundreds of people make a living in different ways from the shrine — some by selling turtle food, some as caretakers, and many others by begging from the visitors and pilgrims.

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22. OCCURRENCE OF THE INDIAN BLACK TURTLE *MELANOCHELYS TRIJUGA* IN SIMBALBARA SANCTUARY, HIMACHAL PRADESH

The Indian black turtle or pond terrapin (*Melanochelys trijuga*) is one of the most common and widespread of the Indian freshwater turtles. Seven subspecies have been described, of which four are distributed within Indian limits, namely peninsular black turtle (*M. t. trijuga*), Cochin black turtle (*M.t. coronata*), Bangladesh black turtle (*M.t. indopeninsularis*) and Sri Lankan black turtle (*M.t. thermalis*). The others, namely the Burmese black turtle (*M.t. edeniana*), Parker's black turtle (*M.t. parkeri*) and Thai black turtle (*M.t. wiroti*) are distributed in Burma, Sri Lanka and Thailand, respectively. Daniel (1983) reported *Melanochelys trijuga* to be a peninsular species (below 20° N latitudes), with a possibility of it occurring further northwards. However, more recent surveys have revealed that it is distributed as far as north-west Bihar (Valmiki Nagar, West Champaran; Moll and Vijaya 1986), Nepal (Royal Chitwan National Park; Dinerstein *et al.* 1987) and in north-eastern India (Assam and Meghalaya; Das 1990). In this paper, we report the occurrence of *Melanochelys trijuga* in Simbalbara Sanctuary, Himachal Pradesh.

Simbalbara is a 19 sq. km sanctuary which lies in the Shiwalik region (Outer Himalaya) in Sirmaur District of Himachal Pradesh. The sanctuary is covered by moist salbearing forests (Type $3C/C_2$ of Champion and Seth 1968) and is the westernmost limit of sal (*Shorea robusta*) distribution in India. The valleys and low-lying reverine areas have sal forests dominated by *Shorea robusta - Ougeinia ougeinensis — Buchanania lanzan* associates, whereas, the hills have mixed forests dominated by *Anogeissus latifolia — Acacia catechu — Boswellia serrata* associates.

On 18th April 1993, one of the authors (A.P.) collected a specimen of *Melanochelys trijuga* in the sal forest. This specimen was found about 10 m from a perennial stream at around 14:15 hours (alt. 450 m.s.l.). The turtle, a male was apparently feeding when first located in a thick layer of sal leaves. It was photographed and released. The posterior marginals were broken indicating a possible attempt of predation on this individual. The turtle excreted on being handled, the faeces showing remains of leaves, ants and crustaceans. The turtle was active and moving although the temperature was 41° C.

On 6th June 1993, the second author (T.J.) collected and photographed another live specimen of the same species. This individual was also an adult male and was located around 5 m from a stream, covered with sal leaves. The specimen had a broken marginal scale and was found *c.* one kilometre upstream from where the former specimen was located. Its morphometric measurements were as follows: straight carapace length: 194 mm, straight carapace width: 142 mm and shell height: 68 mm. Enquiries with locals about the frequency of its sightings, revealed that this species is common all along the edge of the river and in the forested regions with streams and pools, in Simbalbara Sanctuary.

The seven subspecies that are currently recognized, are differentiated predominantly on head coloration. Although the head was blackish in colour, no distinct characteristics for subspecific identification were observed. Moll and Vijaya (1986) had indicated that the subspecies *M.t. indopeninsularis* may be

distributed further north-west in parts of Uttar Pradesh and Nepal. Recently, Das (1991) has also recorded *M.t. indopeninsularis* from Corbett National Park (Uttar Pradesh). The specimens observed at Simbalbara Sanctuary are thus suspected to be *M.t. indopeninsularis*. Nonetheless, the presence of this species in Himachal Pradesh, northwest of its previously known range, is a record of considerable importance. We suggest that more survey and collection of specimens be made for allocation of subspecies and commenting further on their distribution.

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23. PRESENCE OF THE COMMON INDIAN BRONZEBACK SNAKE (*DENDRELAPHIS TRISTIS*) IN RAJASTHAN

The common Indian bronzeback or Tree Snake (*Dendrelaphis tristis*) is a highly arboreal snake, living almost entirely on trees and shrubs. According to Daniel (1983 THE BOOK OF INDIAN REPTILES), it is distributed in peninsular India, Gangetic Plain and Himalayan foothills. It is worth noting that this snake is present in the southern part of Rajasthan State where it is locally called *Udani*, i.e., one which flies. This name is derived from the rapid movement of the snake. This snake has been seen by me many times in the dense forests of Jhadol and Ogana Forest Ranges of Udaipur (North) Forest Division. These forests are rich in plant species. The major plant species are: *Tectona grandis*, *Butea monosperma*, *Wrightia tinctoria*. *W. tomentosa*, *Diospyros melanoxylon*, *D. montana* var. *cordifolia*, *Santalum album*, *Saccopetalum tomentosa*, *Sterculia urens*, *Lannea coromandelica*, *Alangium salvifolium*, *Anogeissus latifolia*, *A. sericea*, *Acacia catechu*, *Albizia procera*, *Dalbergia paniculata*, *Syzygium heyneanum*, *Mitragyna parvifolia*, *Aegle marmelosa*, *Limonia acidissima*, *Pongamia pinnata*, etc. The density of vegetation is high in many pockets, where crown contact stage prevails round the year even in the summer. This condition presumably facilitates movement of the tree snake from one tree to another.

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24. UNUSUAL CAUDAL SCALES OF BUFF-STRIPED KEELBACK *AMPHIESMA STOLATA* (LINNAEUS)

On 18.7.1993, I captured a 417 mm long buff-striped keelback snake, *Amphiesma stolata* (Linnaeus) from Mahipal Reserve Forest Block in southern Aravallis. Its caudal scales had an unusual arrangement pattern. The arrangement of anal and caudal scales (from cloaca to tail end) is given below:

Anal	Paired
Caudals (1 to 4)	Paired

Caudals (5 to 13)	Unpaired
Caudals (14 to 27)	Paired
Caudals (28 to 29)	Unpaired
Caudals (30 to 40)	Paired
Caudal (Terminal)	Unpaired.

Subsequently, I captured two more snakes from the same locality but both had the usual paired caudal scales, except the terminal one.

June 11, 1994

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25. THROAT COLORATION IN FEMALE *MICROHYLA ORNATA* (DUM. & BIBR.)

Microhyla ornata (Dum. & Bibr.) is a small microhylid. In Rajasthan, this species is confined to the southern Aravallis (McCann 1943, Mansukhani and Murthy 1964, Sharma, in press).

Daniel (1963) and Mansukhani and Murthy (1964) have described the coloration of this species. According to them, the colour of the ventrum of this species is white, although throat and chest may be stippled with brown. During the breeding period (i.e. rainy season) the throat of males appear black. In July, 1993, I collected many gravid females from various localities in Udaipur district. The throats of all the females were black similar to the males. I have seen the same coloration during the winter. Hence differenciation of sexes on the basis of throat coloration is not possible.

June 11, 1994

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26. ADDITIONS TO THE LEPIDOCEPHALID FISHES OF BIHAR, INDIA

Introduction

During the course of studies on the hill-stream fishes along the Nepal-Bihar border, three specimens of Lepidocephalids were collected from the river Pandai of Bihar, which, on examination, were identified as *Lepidocephalus annandalei* (Chaudhuri), *L. guntea* (Hamilton) and *L. thermalis* (Valenciennes). The river Pandai rises in Sumeswar range of Nepal territory and enters the district of West Champaran through a pass between the Sumeswar range and Churiaghat at Bhikhanathori. It is joined by several rivulets arising from the Someswar range and ultimately drains into the Ganges river system. A perusal of existing Indian literature on the ichthyofauna including Das (1939), Menon (1950), Hora (1953), Jhingran (1956) and Venkateshwarlu (1977) reveals that two of the loaches, *Lepidocephalus annandalei* (Chaudhuri) and *L. thermalis* (Valenciennes) were not previously recorded from Bihar, and are, therefore, additions to the ichthyofauna of Bihar.

Descriptions

Lepidocephalus annandalei (Choudhuri)

Local name: Nakati; **English name:** Annandale loach.

Material examined: 1 ex., 47 mm TL, Bhikhanathri, Pandai river, Bihar, S.K. Mishra : 6 April 1978.

Diagnostic features: D ii 7; P 8; V 7; A ii5; C 16.

Length of head 6, depth of body 5.9, both in total length. Eye diameter 4 in length of head, equal to interorbital width; predorsal length 2.5 in total length.

Barbels 2 pairs, maxillary and rostral pairs of barbels small.

Dorsal fin origin between eye and base of caudal fin. Caudal fin slightly emarginate; ventral fins nearly opposite to dorsal fin; scales indistinct.

Colour in life; Body dirty yellowish; a black band extending mid-laterally from posterior margin of head to base of caudal fin; head with numerous black spots; dorsal fin with three black spots, anal with two and caudal fin with two dark spots encircled in white rings.

Distribution: Northern India, Nepal and Bangladesh. The present record is a noteworthy addition to the fish fauna of Bihar.

Lepidocephalus thermalis (Valenciennes)

Local name: Nakati; **English name:** Burmese loach.

Material examined: 1 ex., 36 mm TL, Bhikhanathori, Pandai river, Bihar, S.K. Mishra, 6 April 1978.

Diagnostic features: D ii 6; P i 6; V7; A ii 5; C 16.

Length of head 5.5, depth of body 9, both in total length. Eye diameter 3.1 in length of head, entirely in anterior half of head.

Barbels 4 pairs, rostral, inter-maxillary, maxillary and mental pairs.

Dorsal fin origin opposite to ventral fins, caudal fin slightly emerginate. Scales unconspicuous, about 30 rows between the anal fin abse and back. Lateral line absent.

Colour in life: Body yellow with iridiocytes on head, blotches on back and on lateral line; base of upper half of caudal fin with a black spot; a dark streak extending from eye to end of snout; dorsal fin with black spots, and four bands on caudal fin.

Distribution: India, coastal districts of Kerala, Karnataka and Maharashtra, and Sri Lanka. The present record is an addition to the ichthyofauna of Bihar.

KEY TO SPECIES *Lepidocephalus*

1. (a) Caudal fin with two dark spots encircled in white rings ..... *L. annandalei* (Chaudhuri)
   (b) Caudal fin with one or numerous spots but not encircled in white rings.....2
2. (a) Length of head 6.5-6.7, depth of body 5.7-6.5 in total length ..... *L. guntea* (Hamilton)
   (b) Length of head 5.5-6.0, depth of body 8.1-9.7 in total length ..... *L. thermalis* (Valenciennes)

DISCUSSION

These loaches are bottom dwellers, found in swift streams, rivers and lakes of hilly areas and are able to burrow and quickly disappear, if alarmed. The spinous first pectoral ray helps in "digging in".

They are of little interest in fisheries but *Lepidocephalus thermalis* (Valenciennes) is valued as an aquarium fish. They are small but nourishing fish, eaten locally as they are not suitable for transport in fresh state, nor sufficiently common at any one place for large scale processing.

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27. ON *PUNTIUS SETNAI* CHHAPGAR AND SANE: NEW REPORT AND COMMENTS

(*With a text-figure*)

A barb, identical in description with *Puntius setnai*, described by Chhapgar and Sane (1992), has recently been collected from South Kannara (Hoshangadi, S. Kannara, Karnatak State, date of collection 2/9/1991, collected by S. Kamble, WRS, ZSI, Pune, reg. no. V/1516). According to the collector, the fish is very common in the shallow streams of the area.

A line drawing showing salient taxonomic features of the fish is presented here (Fig. 1).

Comments: This barb was first identified as *Puntius nigrofasciatus* on the basis of a few specimens collected by ZSI personnel from a rivulet in the forested area of Ponda, Goa (Yazdani 1977). The fish was described to possess three vertical bands on the body, serrations on the last undivided dorsal ray and complete lateral line with 20-22 scales. Barbels were found to be absent. Fin-ray counts and other details of the specimens were not given (Yazdani 1977). Later, Chhapgar and Sane (1980) pointed out that the fish described by Yazdani (1977) is *Puntius narayani*. This statement was based on the observations carried out on the ZSI specimens mentioned above (fishes from a rivulet in Ponda, Goa, date of collection 13/12/73, name of the collector B.S. Lamba, determined as *P. nigrofasciatus* by G.M. Yazdani). Obviously these authors had overlooked the serrated nature of the dorsal spine.

While examining recent collections from S. Kannara, we came across these 3-banded barbs again. We found that the specimens are exactly like the ones collected from Ponda, Goa in 1973. The fish could not be easily placed anywhere in the latest key and

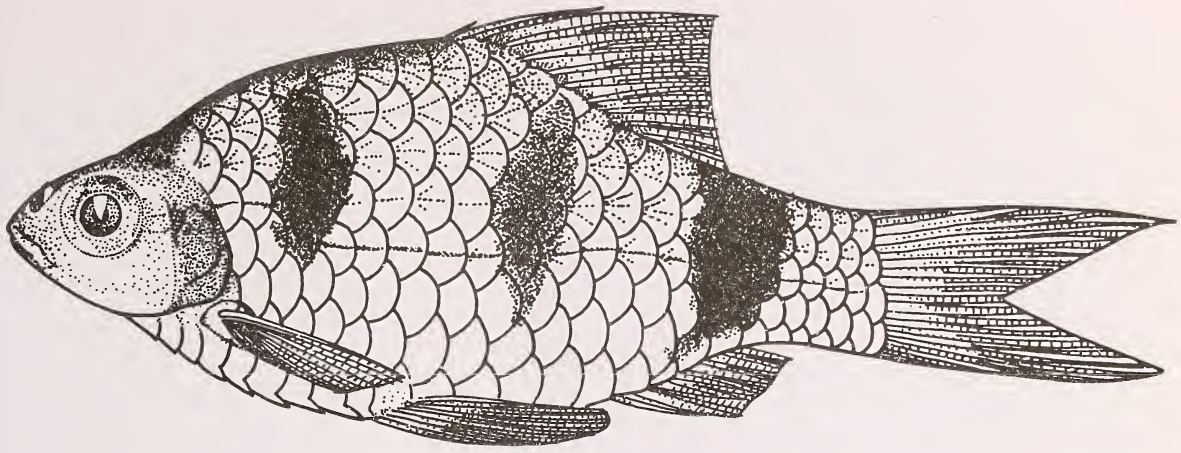

Fig. 1. *Puntius setnai* fish showing taxonomic details.

revision of genus *Puntius* by Jayaram (1991). The serrated dorsal spine and different pattern of bands than that of *P. narayani* and *P. nigrofasciatus* were noticeable features. We were in the process of comparing this barb with the holotype of *P. narayani* to check the possibility whether this barb could be a variant of already described species. This was necessary because the fishes of the genus *Puntius* are much generalised and exhibit variations, both within individuals of the same species and also within the same sex (Jayaram 1991). Apart from variation in colour, it has been stated that even the serrations on the dorsal spine later become indistinct in some species (for example in *P. phutunio* and *P. cumingii* see Jayaram 1991).

It appears certain that this barb is different from those described earlier and is similar to one described as *P. setnai.* The fish fits within the "*fasciatus*" group due to the following characters: (1) body with vertically coloured bands ranging from 3 to 7, (2) deep bodied fish 2 to 4 times in standard length, (3) lateral line scales 18 to 24 (20 to 22 common), (4) predorsal scales most often 6 to 9, (5) lateral line complete or incomplete, (6) 4 to 8 scales between pelvic and anal fins. It appears close to "*cumingii*" complex (though members of this complex, described so far, are known to be endemic to Sri Lanka) (Jayaram 1991).

We are grateful to the Director, Zoological Survey of India, Calcutta, for permission to carry out this work and publish the findings. Thanks are also due to the authorities of Modern College, Pune, for encouragement and facilities.

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28. NEW ADULT MALE ATTRACTANTS OF DANAID BUTTERFLIES

Earlier Amladi (1975) and Chaturvedi and Satheesan (1979) had reported adult Danaid Butterflies visiting *Heliotropium indicum* and *Crotalaria retusa* for Pyrrolizidine alkaloids and Monocretolene respectively. According to Ackery and Vane—Wright 1984), while working on Butterflies of Borivli National Park, I came across two new adult male attractant belonging to family Boraginaceae, i.e. *Trichodesma indicum* R. Br. Prodr., and *Paracaryum coelestinum.* The *Trichodesma* is annual herb much branched, hispid, 45-50 cm tall and bears paleviolet blue flowers. Though it emerges during mid of June and grows till December the butterflies, i.e. *Euploea core*, and *Euploea klugii* visit this plant in late august till October. On 23rd August I saw *Euploea core* hovering around the *Trichodesma* plant and alighting near the top of the plant rather than on the flowers. A closer look revealed that the butterfly uncoils its proboscis and rubs it on the hispid stem. When disturbed it flew around and returned to the same branch. Till September end the main visitors of *Trichodesma* plant were *Euploea*'s. Later the *Danaus genutia, Danaus chrysippus, Tirumala limniace* were also seen visiting these plants and rubbing their proboscis on the hairy stems. In all cases butterflies invariably settled near the apical region of the plant. Individuals of two or three species were also seen on the same plant at a time. The time spent by the butterflies on a plant varies from a few seconds to 8 mintues.

Trichodesma is a genus of about 35 species distributed mainly in tropics and sub-tropics of the old world.

According to Miller and Morris (1988) some *Trichodesma* species are like the heliotropes known to contain pyrrolizidine alkaloids. Apparently this may be the reason why males of the Danaid butterflies visit this plant to obtain important precursor for the male phermones. Haribal (1992) has reported the Blue Tiger *Tirumala liminiace* and Common Indian Crow *Euploea core* visiting dried plants of *Paracaryum coelestinum.* Subsequently I had also observed the *Euploea core* and *Euploea klugii* Moore visiting this plant. *Paracaryum* is erect branched herb around 1 to 1.5 m high, the stem and branches are red pubescent when young and become glabrous later.

The butterflies settle on the dried plant and rub their proboscis when disturbed they fly in an area of around 4 m and return to same spot.

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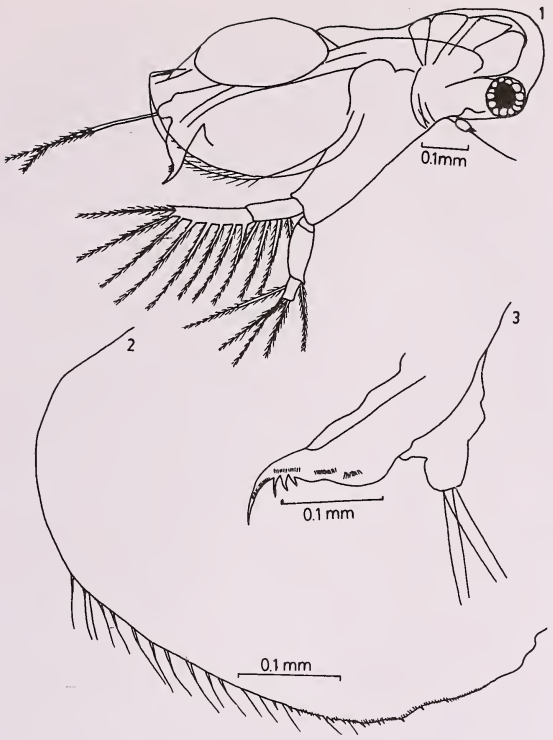
29. OCCURRENCE OF PALAEARCTIC CLADOCERA *DIAPHANOSOMA BRACHYURUM* (LIEVEN) IN WEST BENGAL

(*With three text-figures*)

During a survey of the wetlands of Hughly District of West Bengal, we came across a palaearctic species *Diaphanosoma brachyurum* (Lieven), of the family Sididae. Three species of the genus *Diaphanosoma*, viz. *D. senegalinsis*, *D. excisum* and *D. sarsi* (Michael and Sharma 1988) have been reported from India, Brehm (1936) reported the present species from Kashmir. Subsequent record of this species is from Bangladesh (Khan *et al.* 1988). The present study reports the occurrence of this species in a pond at Hughly District, West Bengal (22° 53' N, 87°56' E), with a short description.

Diaphanosoma brachyurum (Lieven) (Figs. 1-3)

FEMALE: Body size 8.8 mm. Head large, without rostrum, fornix or ocellus. Carapace almost oblong; postero-dorsal corner with a distinct angle, dorsal



Figs. 1-3. *Diaphanosoma brachyurum* (Lieven) Female
1. Lateral view; 2. Ventral margin of valve; 3. Postabdomen.

margin slightly arched (Fig. 1). Ventral margin of valves series of setae, distal part of ventral margin with small denticles (Fig. 2). Head large, with sloping anterior margin. Eye large, located near the anterior ventral margin of head. Antennules small, truncated, with terminal olfactory setae and a single flagellum. Antennae not reaching posterior end of valves. Postabdomen narrow. Claw with three basal spines decreasing in size proximally and with setae on its concave margin (Fig. 3).

Remarks: *D. brachyurum* is considered to be one of the northern species occurring in India. Brehm (1936) reported this species from Kashmir, Khan *et al.* (1978) from Bangladesh and Fernando & Kanduru (1984) from Bhopal. Khan *et al.* (1978) described this species with postabdominal claw having two basal spines. This is rather surprising as no species of *Diaphanosoma* has two basal spines. They also stated that this species can be differentiated from *D. leuchtenbergianum* by the length of the antenna and number of basal spines of the postabdomen.

From previous studies it is clear that the presence of three basal spines is a generic character.

We are grateful to the Director, Zoological Survey of India, Calcutta, for facilities provided and Dr. N.C. Nandi for his encouragement.

July 31, 1993

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30. *SPONDIAS ACUMINATA* ROXB.

February 1992 I received from the Botanical Survey of India, Western Circle, Poona, some fruiting specimens of *Spondias acuminata* Roxb., collected near the Kanheri caves near Bombay, the type locality and one specimen from a tree, growing on the Campus of the Poona (Pune) Univeristy.

This enables me to provide some description of the species, although the flowers are still missing.

Spondias acuminata Roxb.

Hortus Bengal. 34. 1814 (nomen); Fl. Indica, ed. Carey 2: 387. 1832; ed. Wall. 2:453. 1834; Wight & Walker-Arnott, Prodr. Fl. Penins. Ind. or. 1: 173. 1834; Steudel, Nomencl. Bot., ed. 2, 1:625. 1840; Walp., Repert. 1: 556. 1842; Voigt, Hort. suburb. Calc. 144. 1845; Hooker f., Fl. Brit. Ind. 2: 42. 1876;Kurz, J. Asiat. Soc. Bengal 45(2):

213. 1876; Engler in DC., Monogr. Phaner. 4: 249. 1883; Graham, Catal. Bombay Pl. 1: 352. 1909; Gamble, Fl. Pres. Madras 1: 262. 1918 (in oberv.); id., Kew Bull. 226. 1918; Craib, Fl. Siam. Enum.1:255. 1926 (quoad nomen?); Airy Shaw & Forman, Kew Bull. 21(1): 8. 1967 (as a synon. of *Sp. pinnata*); Almeida, Fl. Savantwadi : 113. 1990; Kostermans, Kedondong, Ambarella, Amra. The Spondiadeae (Anacard.) of Asia and the Pacific Area: 63. 1991 (Bogor, Indonesia). Proposed lectotype : Graham s.n. (K), Kanheri (Kennery) Caves near Bombay (topo-type).

Cat-Ambalam, Pee-Ambalam, Rheede, Hort. Ind. Malab. 1:93. 1678 (no plate, the plate indicated is that of Ambalam = *Sp. pinnata*); Nicolson & al., Interpret. Rheede, Hort. Mal., Regnum Veget. 199:89. 1988.

Katampazham, acc. to Nicolson; Ranawade, acc. to Almeida; Ambada (Kanheri Caves).

Tree, *c.* 15 m tall. Terminal bud glabrous. Leaves aggregate, glabrous, thickish (fresh, when dried papyraceous), imparipinnate, up to 30 cm long; bare part of rachis up to 8 cm, smooth. Folioles opposite, 2-5 pairs, thickish (when dried very thin), ovate or broadly elliptic, 3 x 5 (lower ones) - 5.5 x 9 cm (apical one), conspicuously caudate-acuminate, entire, acumen slender, 2-9 mm long, above smooth, midrib, thin, prominent, laterals numerous, straight, parallel, filiform, erect-patent (lower ones), connected into a thin marginal nerve, between the ribs an obscure, lax reticulation; petiole 5-15 (terminal one) mm long, apical part with narrow triangular decurrent wings. Flowers appear on the bare branches (not seen), fruit developes with the new leaves and ripens, when the leaves drop.

Fruit on a short infructescence, elliptic to subobovoid, pointed at one end, up to 3.5 x 4.4 cm, yellow when mature, smooth, glossy, mesocarp very thin, acid-astringent; endocarp woody, very large, ellipsoid, consisting of a winged inner part, the wings very broad with in between them a little parenchyma, the whole surrounded by a thin capsule of close fibres with some tiny holes; no fibres in the mesocarp. In one specimen 3 developed ovules.

Distribution: Peninsular India, perhaps Burma and Thailand.

Specimens examined: Garden of the Botany Dept. of the Poona University, Pune-7, Jan., mature fr., *S. Karthikayan*, Bot. Surv. Ind. 121894; Borivli National Park, Kanheri Caves, 450 m alt., Dec. fr., *Venkanna*, Bot. Surv. 107995 and 107998; ibid., 425 m alt., *Venkanna*, Bot. Surv. 107994.

Note: Indication of a neotype is better postponed, until flowering material is available.

As I discussed in my treatment of the species in 1991, Airy Shaw and Forman suggested, that part of a Wallich sheet at Kew might represent *S. acuminata*, collected from Roxburgh's tree in Calcutta. After having examined now the leaves of the species, it becomes more likely, that a part of the Wallich material might represent *S. acuminata*, as there is no difference between the folioles of *S. pinnata* and *S. acuminata*, except the larger size of the former and the slightly less pronounced acumen.

As there is now a specimen of *S. acuminata* growing on the campus of the Pune (Poona) University, I suggest, that a specimen of *S. pinnata* be planted next to it. This will enable Indian botanists to study both species intensively and discover the differences.

The information on the labels of the material, collected by the Botanical Survey, are poor and inadequate. Nothing is said about buttresses (if any), about their number, size, shape, thickness, nothing is said about the characteristics of the dead and live bark (thickness, way of peeling off, colour, taste and smell), nothing about the sap- and heart-wood (merging or defined, colour, hardness, etc.).

If flowers become available, the label should have annotations about the colour of the inflorescence peduncle and stalk, their consistency (diam.), the colour, shape, consistency of calyx and petals, whether the petals are esplanate or reflexed; the number of stamens, the size and thickness of the filaments, the size and length of the style and the size and shape of the stigma (the latter important), the size and thickness of the pedicel.

With all the above information at hand, I am sure that more differences between the two species will turn up.

August 13, 1993

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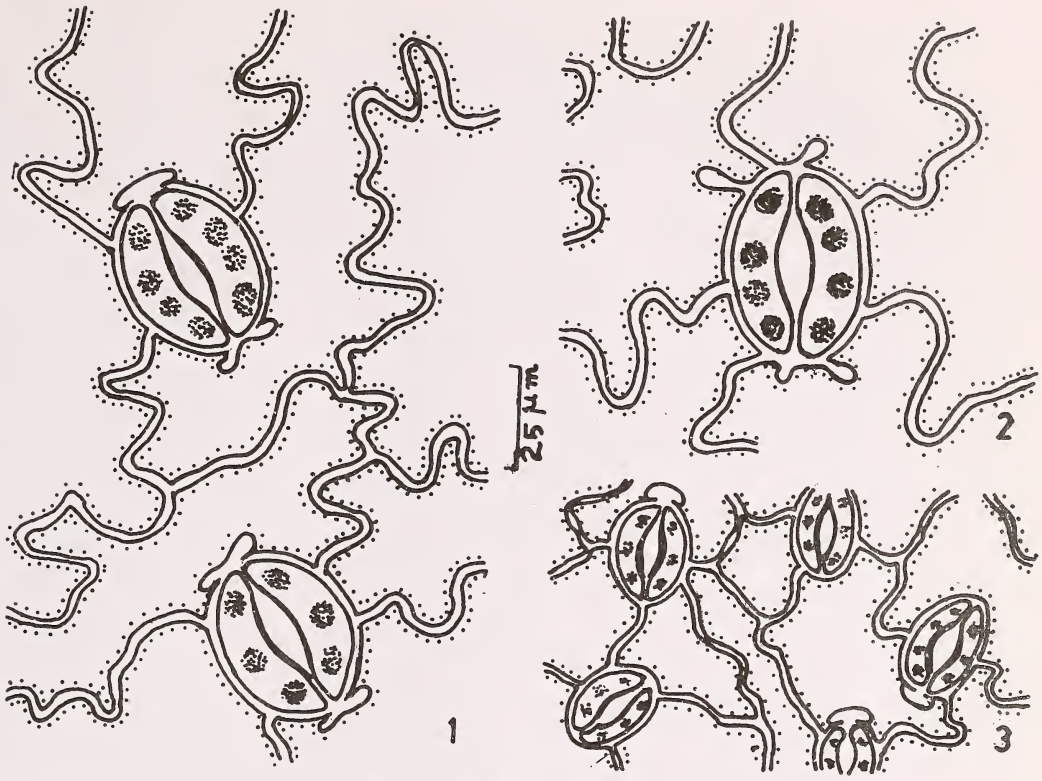
31. ON THE STOMATAL PECULIARITIES IN MYRTALES

(With three text-figures)

While studying the epidermal morphology and stomatal ontogeny in 60 species under 35 genera of nine families of the order Myrtales, were encountered certain interesting peculiarities in the polar regions of the stomata of some members. Their structural features and uncommon occurrence have necessitated this report.

Usually the inner wall of guard cells lining the stomatal pore is highly thickened. In *Osbeckia octandra*,



Figs. 1-3. Leaf - abaxial epidermis.
1, 2. *Calycopteris floribunda*; 3. *Osbeckia truncata.*

O. truncata, *O. zeylanica* (Melastomataceae), *Anogeissus latifolia* and *Calycopteris floribunda* (Combretaceae) atleast some stomata show unusual thickening of outer walls at one or both poles (Figs. 1,3). In those stomata the lateral part of the outer wall of the guard cells is completely thinner than the part at the polar regions. Due to this wall thickening arch-like structure appears prominent at the polar regions of the stomata. The wall thickening may even extend from the middle of the arch to the common inner wall of the guard cells for a short distance; hence they were called T-shaped thickening by Stace (1965). The above type of uncommon thickening has been reported in some members of Combretaceae, namely species of *Strephonema*, *Pteleopsis, Ramatuella* and *Terminalia* (Stace 1965), in seven species of Zingiberaceae, Cannaceae, Rubiaceae and Theaceae (Raju *et al.* 1975) and *Tradescantia* (Tikku *et al.* 1978).

Our histochemical studies also confirm the PAS positive nature (Raju *et al.* 1975) of the T-shaped thickenings and reveal that the presence of insoluble polysaccharides in the thickened wall. The present study confirms that though, this type of thickening is rare in the stomata of angiosperms, it appears to be common in the member of the family Combretaceae as several species of this family possess this thickening.

Interestingly, besides the above type of thickening, some stomata of *Calycopteris floribunda* (Fig. 2) possess peg-like extensions which extend from the stomatal pole into the cavities of subsidiary cells. Such extensions have been reported earlier only in *Penaea myrtoides* and *Sarcocolla fucata* (Metacalfe and Chalk 1950).

The functional role of these thickenings and peg-like extensions is not definitely known.

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32. NEW RECORDS OF FABACEAE FROM GARHWAL HIMALAYA

(With four text-figures)

Situated in the central part of North-west Himalaya. Garhwal Himalaya have attracted attention of several plant explorers (Hooker 1876, Duthie 1903, Osmaston 1927, Babu 1977, Naithani 1985, Gaur 1987, Gaur *et al.* in press). This communication includes rare and interesting specimens of the Fabaceae with short notes on the distribution, localities, approximate elevation and collector's herbarium number, along with their line diagrams.

The voucher specimens after following usual Herbarium methods are deposited and maintained at the Herbarium Department of Botany, H.N.B. Garhwal University, Srinagar Garhwal.

Desmodium laxum DC., Ann. Sci. Nat. Paris 4: 1022. Jan. 1825 & Prod. 2: 336. 1825; Sanjappa, Leg. Ind. 156. 1992. *Desmodium podocarpum* DC. var. *laxum* Baker in Hook. f., FBI. 2: 165. 1876. (Fig. 1).

Distribution: Pinswar, Tehri Garhwal, 1600 m a.s.l

Collector's Herbarium No.: GUH - 20002.

Specimens Examined: BSD - 8501.

The plant species was collected by Hooker (1876) from temperate and tropical Himalaya without any definite locality and Sanjappa (1992) from West Peninsula, Eastern Himalaya, Assam, etc. This is a rare collection for this region.

Desmodium neomexicanum A. Gray, Pl. Wright 1:53. 1852; Sanjappa, Leg. Ind. 159. 1992. *Desmodium spirale* DC. Baker in Hook. f., FBI. 2: 164.1876; Duthie, Fl. Upp. Gang. Plain 284. 1903. (Fig. 2).

Distribution: Towards Chelusain, Pauri Garhwal, 1600 m a.s.l.

Collector's Herbarium No. : GUH-20070.

Specimen Examined: DD - 12.

Hooker (1876) reported the plant species from North-West Provinces and Sanjappa (1992) from Gujarat, Uttar Pradesh. This is a new record as well as rare collection for this region.

Lotus corniculatus L. Sp. Pl. 773. 1753. var. **tenuifolius** L. Sp. Pl. 776. 1753; Sanjappa, Leg. Ind. 206. 1992. *Lotus corniculatus* L. var. *minor* Baker in Hook. f., FBI. 2: 91.1876. (Fig. 3).

Distribution: Garurchatti, Chamoli garhwal, 3300 m a.s.l.

Specimens Examined: BSD - 36386.

The plant species was reported by Hooker (1876) from Western Himalaya without any definite locality and Sanjappa (1992) from temperate Western Himalaya as well as Punjab Plains.

Trigonella fimbriata Royle ex Benth. in Royle, Illust. Bot. Himal. 197. 1835; Ali in Nasir & Ali, fl. W. Pak. 298. 1977; Sanjappa Leg. Ind. 264. 1992. (Fig. 4).

Distribution: Above Kedarnath, Chamoli Garhwal, 3700 m a.s.l.

Collector's Herbarium No.: GUH - 26050.

The plant species is collected by Ali (1977) from Kashmir, North Punjab, Kumaon and Nepal. This is a rare collection from Garhwal, Himalaya.

ACKNOWLEDGEMENTS

We are thankful to the authorities of Botanical Survey of India, Northern Circle, Dehradun (BSD) and Herbarium, Forest Research Institute, Dehradun (DD) for providing herbarium facilities. Financial assistance from Department of Environment, Govt. of India, New Delhi is also thankfully acknowledged.

August 15, 1993

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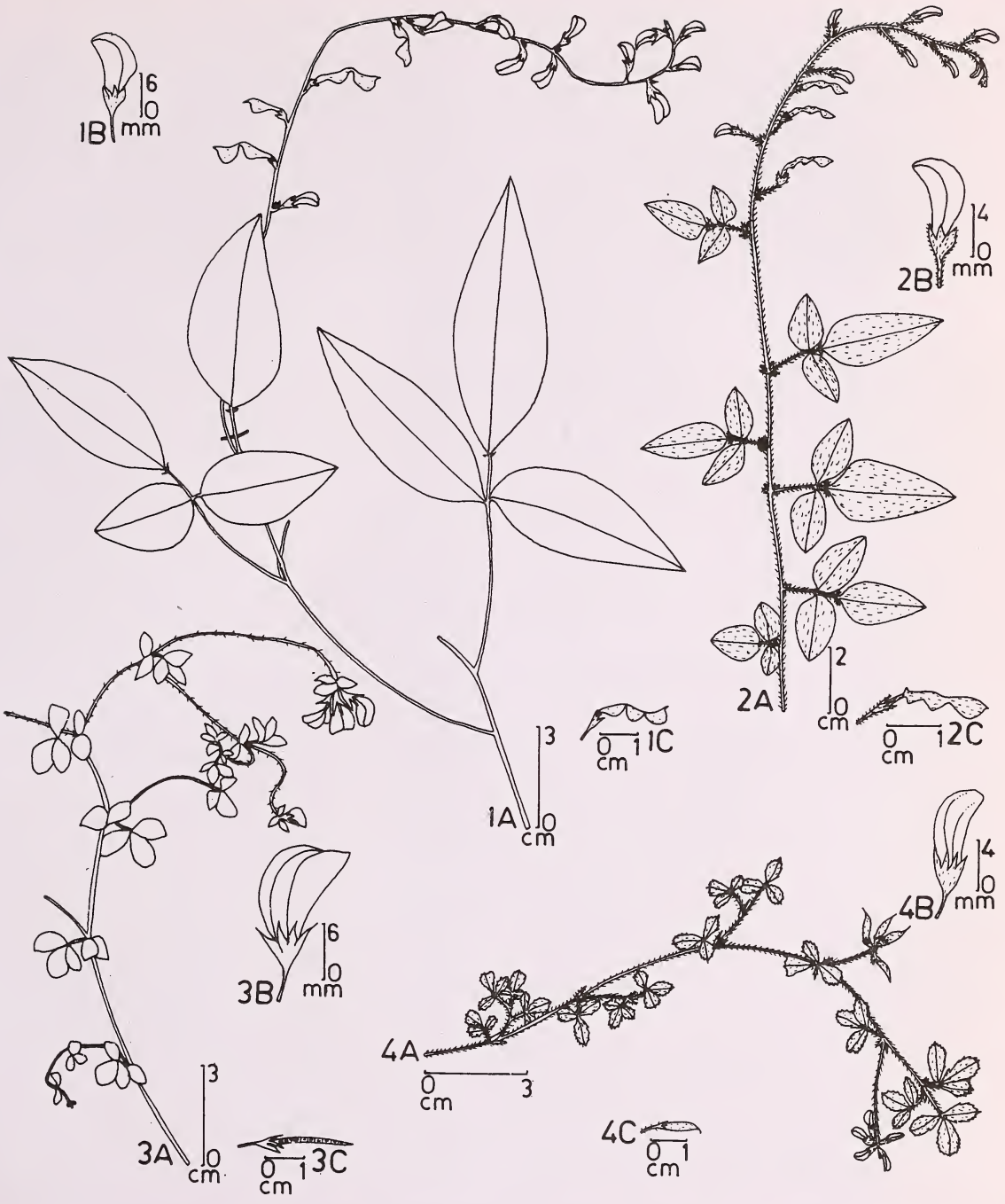

Fig. 1A - C. *Desmodium laxum*: A. Flowering and fruiting branch; B. Flower; C. Pod. Fig. 2A - C. *Desmodium neomexicanum*: A. Flowering and fruiting branch; B. Flower; C. Pod. Fig. 3A - C. *Lotus corniculatus* var. *tenuifolius*: A. Flowering and fruiting branch; B. Flower; C. Pod. Fig. 4A - C. *Trigonella fimbriata*: A. Flowering and fruiting branch; B. Flower; C. Pod.

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33. THE *ENTADA* ADANS. (MIMOSACEAE) PUZZLE

In 1980 (Notes on Ceylonese plants I, Miscellaneous papers, Landbouwhogeschool, Wageningen 19: 223-227) I tried to disentangle the confused nomenclature of the genus *Entada* Adans. (nomen conserv.), but for lack of proper flowering and fruiting material, could not arrive at a definite conclusion, which may only be reached, when Indian botanists collect adequate flowering and fruiting material.

The general trend is now to accept a single species of *Entada* in the Indian peninsula, described by Rheede van Draakestein (8:59) and considered to be conspecific with *Entada pusaetha* DC., of Sri Lanka.

This is not proved and Indian botanists are invited to pursue this matter.

In Sri Lanka two species of *Entada* occur, one *E. pusaetha* DC., an enormous liana with a straight enormous pod, up to 1 m long and very large, round, compressed conspicuous seeds, up to 10 cm diameter. The specific name is derived from Hermann's Museum zeylanicum, the Catalogue of the Hermann collection of plants in the Natural History Museum, London. There is no herbarium specimen of this plant in Hermann's herbarium and Linnaeus hence included it in his Flora Zeylanica of 1747 under the "Barbarae annihilatae" (plants with a local name, but without herbarium material).

Pusaetha means, sinhala language: Pus (pronounced poos), the name of the plant (its meaning: hollow). The plant is called in Sinhalese: Pus wael (wael: climber); aetha (Sinhalese: Etta) means seed; apparently Hermann was only aquainted with the seeds.

De Candole called it pursaetha, manifestly a typographical error.

In Sri Lanka another species occurs, called in Sinhala: Heen pus wael (heen = small), a much smaller liana, with a pod only half the size of that of *E. pusaetha* and with the apical part bent and partly twisted (not straight as in *E. pusaetha*), the seeds not more than 3-4 cm in diameter. I have described it as *E. zeylanica* in the paper quoted above (page 226). *E. zeylanica* is found in other areas than *E. pusaetha*. I found it in the forest park above the city of Kandy, where I could study it at leisure. The pods have always the same shape. The small seeds have puzzled Ceylonese botanists for a long time; they were familiar only with the large seeds of *E. pusaetha*.

The question is now: what is the identity of *E. monostachya* DC. (a synonym of *E. rheedii* Sprengel, Syst. veg. 2: 335. Jan.-May 1825)

It might be *E. pusaetha* DC. with the long straight pods and the large seeds or *E. zeylanica* with the short, partly bent and twisted pods and small seeds.

At any rate Nielsen (Fl.) Thailand 4:144 1985) is in error, when he described the pods of *E. rheedii* as having either straight or curved pods, the size of the seeds (3-4 cm diam.) as described by him, points to *E. zeylanica* Kostermans.

I wrote this article in context with a note of A.S. Reddy in the *Journal of the Bombay Natural History Society 87(1):* 170-171. (1990).

August 13, 1993

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34. SOME NOMENCLATURAL CORRECTIONS IN GENUS *TOONA* ROEMER

The senior author in 'Flora of Savantwadi' adopted *Toona hexandra* (Wall. ex Roxb.) Roemer for the species commonly found in Maharashtra, known under the name *Cedrela toona* Roxb. in most of our Indian Floras. The decision was based on the various descriptions and synonymy found in the literature. We had no access to the type materials of the species. Although the Flora of Savantwadi was ready for publication in 1983 and was communicated for publication, it was ready only in 1990 due to various reasons. Meanwhile, late Dr. K.N. Bahadur compiled an excellent account of the genus *Toona* Roemer which is published as a taxonomic monograph. This monograph published in 1988, was available for consultation to us only few days ago. It appears that the typical *T. hexandra* is the species restricted to Nepal only and the plant found in our area is *T. hexandra* ssp. *hexandra* var. *gamblei*.

After going through the monograph we noticed that although the work of the monograph is carried out very methodically and with consultation of relevant type materials and examination of hundreds of herbarium specimens in some of the prominent herbaria, the nomenclature used by the author requires revision as per rules of the International Code of Botanical Nomenclature. In this communication, we propose a few nomenclatural changes for some of the taxa given in the monograph, and we accept the typifications and the taxonomic conclusions of Dr. K.N. Bahadur.

We invite attention of the readers to the original work of Dr. Bahadur for complete synonymy and give only the proposed new names along with basionyms and the names adopted by Dr. K.N. Bahadur in the monograph.

1. *Toona hexandra* (Wall. ex Roxb.) Roemer, Monog. Hesperid. 1: 139. 1846. ssp. *hexandra* var. *gamblei* (C.DC.) comb. nov. *T. ciliata* Roem., Monogr. Hesperid. 1: 139. 1846. *Cedrela toona* Roxb. ex Rottl. et Willd. var. *gamblei* C.DC., Rec. Bot. Surv. Ind. 3: 367. 1908.

Under synonymy of *Toona ciliata* Roemer ssp. *ciliata* var. *ciliata*, the earliest available binomial accepted by Dr. K.N. Bahadur is *Cedrela hexandra* Wall. ex Roxb. Some recent Indian botanists notably Dr. Panigrahi (1974) had maintained *Toona hexandra* (Wall. ex Roxb.) Roem. as a distinct species from *Toona ciliata* Roemer. However, Dr. K.N. Bahadur has not treated them as distinct species, but as mere varieties. Therefore, in the species complex, specific epithet *hexandra* has the priority over *ciliata* and consequently, the variety representing taxon known as *ciliata* should be correctly called as *Toona hexandra* (Wall. ex Roxb.) ssp. *hexandra* var. *gamblei* (C.DC.) Almeida & Almeida.

2. *Toona hexandra* (Wall. ex Roxb.) Roemer ssp. *hexandra* var. *griffithiana* (Pierre) comb. nov.

Toona ciliata Roemer ssp. *ciliata* var. *australis* (F. Muell.) Bahadur, Monogr. Toona 78. 1988.

Cedrela australis F. Muell. Fregm. Phyto. Fr. Austr. 1:4. 1858. *T. febrifuga* Blume var. *griffithiana* Pierre, Fl. For. Cochinch. 4: 358. 1897.

Under *Toona hexandra* complex, the earliest varietal name published for this variety is *griffithiana*. Therefore it should be used in new combination for the variety.

3. *Toona hexandra* (Wall. ex Roxb.) Roemer ssp. *hexandra* var. *grandifolia* (C. DC.) comb. nov.

Toona ciliata Roem. ssp. *ciliata* var. *grandifolia* (C. DC.) Bahadur, Monogr. Toona 90. 1988.

C. microcarpa C. DC. var. *gradifolia* C.DC. in Rec. Bot. Surv. Ind. 3: 371. 1908.

4. *Toona hexandra* (Wall. ex Roxb.) Roemer ssp. *hexandra* var. *haslettii* (Haines) comb. nov.

T. ciliata Roemer ssp. *ciliata* var. *haslettii* (Haines) Bahadur, Mongr. Toona 92. 1988.

Cedrela toona Roxb. var. *haslettii* Haines. Fl. Ch. Nag. 250. 1910.

5. *Toona hexandra* (Wall. ex Roxb.) Roem., Syn. Monogr. Hesper. 1 : 139. 1846 ssp. *hexandra* var. *hexandra* (Bahadur) comb. nov.

Toona ciliata Roem. ssp. *ciliata* var. *hexandra* (Wall. ex Roxb.) Bahadur, Mongor. Toona 93. 1988.

6. *Toona hexandra* (Wall. ex Roxb.) Roem. ssp. *hexandra* var. *listeri* (C. DC.) comb. nov.

Toona ciliata Roem. ssp. *ciliata* var. *listeri* (C. DC.) Bahadur, Monogr. Toona 94. 1988. *C. toona* Roxb. var. *listeri* C. DC., Rec. Bot. Surv. Ind. 3: 370. 1908.

7. *Toona hexandra* (Wall. ex Roxb.) Roem. ssp. *hexandra* var. *parviflora* (Benth.) comb. nov.

Toona ciliata Roem. ssp. *ciliata* var. *parviflora* (Benth.) Bahadur, Monogr. Toona 94. 1988.

Cedrela toona Roxb. var. *parviflora* Benth., Fl. Austr. 1: 387, 1863.

8. *Toona hexandra* (Wall. ex Roxb.) Roem. ssp. *hexandra* var. *pilistila* (C. DC.) comb. nov.

Toona ciliata Roem. ssp. *ciliata* var. *pilistila* (C. DC.) Bahadur, Monogr. Toona 95. 1988.

C. toona Roxb. var. *pilistila* C. DC. in Rec. Bot. Surv. Ind. 3: 365. 1908.

9. *Toona hexandra* (Wall. ex. Roxb.) Roem. ssp. *hexandra* var. *pubinervis* (C. DC.) comb. nov.

Toona ciliata Roem. ssp. *ciliata* var. *pubinervis* (C. DC.) Bahadur, Monogr. Toona 96. 1988.

C. toona Roxb. var. *pubinervis* C. DC. in Rec. Bot. Surv. Ind. 3: 368. 1908.

10. *Toona hexandra* (Wall. ex Roxb.) Roem. ssp. *velutina* (Bahadur) comb. nov.

Toona ciliata Roem. ssp. *velutina* (C. DC.) Bahadur, Monogr. Toona 97, 1988. var. *velutina*.

C. velutina C. DC., Prodr. 1:625. 1824. var. *velutina*.

11. *Toona hexandra* (Wall. ex Roxb.) Roemer ssp. *velutina* (Bahadur) Almeida & Almeida var. *candollei* (Bahadur) comb. nov.

Toona ciliata Roemer ssp. *velutina* Bahadur. Monogr. Toona 99. 1988.

12. *Toona hexandra* (Wall. ex Roxb.) Roem. ssp. *velutina* (Bahadur) Almeida & Almeida var. *kingii* (C. DC.) comb. nov.

Toona ciliata Roemer ssp. *velutina* Bahadur var. *kingii* (C. DC.) Bahadur, Monogr. Toona 100. 1988.

Cedrela kingii C. DC., Rec. Bot. Surv. Ind. 3: 371. 1908.

13. *Toona hexandra* (Wall. ex Roxb.) Roem. ssp. *velutina* (Bahadur) Almedia & Almeida var. *mollis* (Hand.-Maz.) comb. nov.

Toona ciliata Roemer ssp. *velutina* var. *mollis* (Hand.-Mazz.) Bahadur, Monogr. Toona 101, 1988.

C. mollis Hand.-Mazz. in Anzeing. Acad. Wissen. Wien. 24: 266, 1920; var. *mollis*.

14. *Toona sinengii* (A. Juss.) Roem. var. *longifolia* (Wall. ex C. DC.) comb. nov.

Cedrela longifolia Wall. ex DC. in Rec. Bot. Surv. Ind. 3: 375. 1908.

C. longifolia Wall. ex C. DC. var. *kumoona* C. DC. l.c. 376. 1908.

C. sinensis A. Juss. var. *shensiana* C. DC. l.c. 361, 1908.

All the three names mentioned in the synonymy above are published in the same publication on the same date.

The latter two names pertain to the varietal rank, whereas the first, only gives a binomial. However, by virtue of publication of a variety of the first, and both the species and variety being taxonomically identical under Article 57.3 of the International Code of Botanical Nomenclature, the binomial *Cedrela longifolia* Wall. ex C. DC. automatically becomes *Cedrela longifolia* Wall. ex DC. var. *longifolia* and it has priority as a varietal name. Therefore the varietal name *longifolia* is selected here for this variety.

15. *Toona sureni* Blume var. *glabrior* (C. DC.) comb. nov.

Cendrela febrifuga Blume var. *glabrior* C. DC. in Mon. Phan. 1: 744. 1878.

C. febrifuga Blume var. *inodora* (Hassk.) C. DC. in Rec. Bot. Surv. Ind. 3: 373. 1908.

C. inodora Hassk., Hort. Bog. 131. 1844.

Toona sureni Blume var. *inodora* (Hassk.) Bahadur. Monogr. Tooona 136. 1988.

Bahadur's varietal name is based on Hasskarl's specific epithet *inodora*. As the rule of priority of publication does not apply outside its own rank, Bhadur's varietal epithet has to be considered as a new varietal name dating from 1988 (See Article 60.1 of ICBN) out of the two earlier varietal epithets, *inodora* has been in use from 1988, and the only unused earlier epithet available for the new combination is *glabrior* which is proposed here in new combination.

16. *Toona sureni* Blume var. *velutina* (Koorders et Val.) comb. nov.

Cedrela febrifuga Blume var. *velutina* Koorders et Val. ex Adelbert, Blumea 6: 313. 1948.

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35. UNUSUAL FLOWERING EPISODES AS A FUNCTION OF RAINFALL IN *ANISOMELES INDICA* O.KUNTZE (LAMIACEAE)

The Labiatae weed, *Anisomeles indica* is an Asiatic herb and occurs in the Philippines, mainland China, Thailand, Taiwan, Timor, Java, Sumatra, Indonesia, Japan, India, Sri Lanka and Australia. This plant is widespread throughout India up to 1600 m at the foot of the Indian Himalaya (Ridley 1967, Uphof 1968, Huang and Cheng 1978). It is a perennial shrubby herb occupying various weedy habitats in both moist and arid soils as per the notes of the herbarium specimens of this plant collected from different countries of Asia by Missouri Botanical Garden, St. Louis, U.S.A. Our observations in Turimella region of Nallamalai forests in Andhra Pradesh, India indicate that it grows in moist sandy loam, lateritic and granitic soils. It is confined to stream edges in irrigated rice fields. We also found it growing well by the side of a field-well in a village, Racherla near Turimella. The soil surrounding the well is wet and a good water source for the plant. Further, a few individuals of this species found in relatively less-water or moisture-saturated soils quickly dried up or disappeared while in vegetative growth or during mid-flowering season. It indicates that the plant is successful only in wet habitats and shows full vegetative and flowering growth as long as there is availability of water or moisture in the soil. Attempts to test this phenomenon in a green house by growing this plant experimentally have been made without success. Because the seeds of this plant did not germinate in different treatments, and it appears that there are unknown barriers for breaking dormancy and subsequent germination. The plant, however, was tested by sowing its seeds in the backyard of the first author's house. The seeds sown on 16.7.1992 germinated on 19.7.1992. It suggests that there is an unknown chemical stimulus present in the soil to quickly break the seed coat of *A. indica* for immediate germination (within three days from the day of sowing). The seeds germinated only in rainy season which bringforth water-saturation to the soil. First flowers on the plant raised from the seeds were observed on 7.11.1992 and the plants continued to flower until 18.2.1993; they, then, showed withering. At this stage, we removed 3/4 of the aerial part of some of the plants to test whether it would again start to regrow immediately from the same stalk. Surprisingly, it started to produce leaves as there is enough moisture in the soil. This response from the plant shows that it is capable of producing leaves and flowers as long as there is enough soil-moisture once it first appeared following the first rains. The last flowers of the plant, however, are small and less conspicuous compared to the first flowers.

The plant flowers annually on a regular basis at about the same dates each year and such on-time phenology according to Opler *et al.* (1976) is due to endogenous rhythms. It naturally starts vegetative growth in October. After a month's vegetative phase, it begins to flower everyday until it withers in January provided there is enough soil-moisture throughout. The plant ceased flowering when there was little moisture and reflowered again when the soil was wet. The soil-moisture in which the plant grows is dependent upon water flow in streams which in turn, is associated with rain. From this account, it is evident that the rainfall plays a key role in regulating flowering in *A. indica.* The flowering episodes in this plant due to water stress is in a way similar to typical episodic flowering as a function of rainfall found in some tropical plants, mostly the herbs and shrubs (Opler *et al.* 1976). These authors view the occurrence of episodic flowering as a bet-hedging strategy in the face of uncertainty in the environment. The uncertainty includes a variety of factors, principally the soil, the weather conditions and the pollinator availability (Gentry 1974). In *A. indica* such unusual flowering episodes within a flowering season as a function of water stress is exhibited in the presence of diverse pollinator species in abundance. Our observations show that the pollinators and other foragers regularly visited the plant until the completion of first episodic flowering. The foragers infrequently foraged on this plant in the next successive episodes. Each of these episodes produced only few flowers per plant and could not draw attention of the foragers. It, therefore, suggests that the phenomenon acts negatively for the success of reproduction in *A. indica* and totally contrasts with the observation of Gentry (1974) as mentioned earlier.

Although rainfall has a great influence on vegetative growth and flowering, it does not regulate the timings of anthesis and anther dehiscence. The two events are postponed by about an hour on cloudy and foggy days. Pollinator activity is similarly delayed.

Our study conclude that flowering in *A. indica* is totally a function of rainfall. This serious drawback cannot be corrected in natural conditions but can be corrected in experimental conditions or in our fields and gardens by periodically wetting the soil. Its allied

species, *A. malabarica* with similar flowering phenology and floral features presents a different story, details of which will be presented in a separate paper. Regardless, *A. indica* is a good ornamental by its pretty size and showy, purple flowers. The plant is a good source of nutrients for diverse species of insects and sunbirds for about 3-4 months.

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36. DOUM PALMS AT BHAMGARH IN INTERIOR RAJASTHAN

After reading in the Botany Notes of the April 1992 JBNHS (Vol. 89 No. 1 p. 151-2) that doum palms are Threatened Plants of India, and unusual in interior areas like West Khandesh, I invite your readers' attention to an extensive dense old stand of doum palms in Rajasthan. They lie along the banks of a small stream feeding the temple tank at Bhamgarh, the ruined capital of the mystic Queen Ratnavati said to have been destroyed by earthquake, not war, these little-known ruins are extensive and interesting.

Bhamgarh is 45 km south of Sariska and 139 km north of Sawai Madhopur, at an unmarked westward U-turn near some scenic cenotaphs on the road, just north of Golkabad, a white-marble carving centre.

Many went forth as merchant seamen from Bhangarh. Once, in a terrible storm, they called upon their saintly queen, who "lifted their ship out of the water in her hand" to safety. Her husband the king demanded an explanation for the water suddenly dripping from her arm as they played chess. His disbelief in her story (later "confirmed by returning sailors) and other events led to her exhortation to her people to quickly abandon their doomed city, she jumped to her death from the battlements just before the earthquake.

The doum palms must have been brought to Bhamgarh by these numerous sailors. It would be worth inquiring whether there was a similar tradition of residents going to sea from the West Khandesh villages near the (unspecified doum palm grove.

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37. THE BRANCHING PALM IN DIU

One of the most striking features of Diu are the dense stands of the Branching Doum Palm. From records in the journal very few botanists seem to know about this palm as being plentiful on Diu and across on the mainland from Una to Kodinar. That the palm was more widespread along the Saurashtra coast can be conjectured from scattered specimens at Veraval, near Miani north of Porbandar, a couple of badly damaged specimens near Dwarka and a fine one Beyt Dwarka off Okha.

The fruit has a thick fiberous pulp which can be sucked. This replaces the fibers of the coconut. The hard nut itself is comparatively small about half that of the coconut. Germination takes place by the embryonic palm moving outside the hard nut. The root rapidly elongates into the soil before the shoot unfurls above the soil. An umbilical chord like connection absorbs the nutrition stored in the hard nut. This type of germination resembles that in the date palm.

May 1, 1993

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38. THE LOCATION OF DRUDE'S LINE IN RAJASTHAN

Introduction

Drude's Line-the line limiting the Perso-Arabian and Indo-Malayan elements, runs along the Aravallis and extends southwards to the Gulf of Cambay (Drude 1890). The location of this line along the Aravallis has been confirmed by Blatter and Hallberg (1920), Blatter *et al.* (1929), Biswas and Rao (1953), Meher-Homji (1970) and Bhandari (1978). However, Nair and Nathawat (1957), Nair and Kanodia (1959), Mulay (1960), Vyas (1962, 1964, 1965, 1967), Ramdeo (1969) and Singh (1977) prefer to shift Drude's line beyond the eastern boundary of Rajasthan.

The taxa occurring in Rajasthan were first listed from the available literature and herbarium specimens. Following this the distribution of these taxa in the world was noted and interpretted to study the phytogeographical status of Rajasthan.

Observations

The flora of Rajasthan comprises 1714 species, including 67 naturalised species of alien origin. The Perso-Arabian element in Rajasthan is represented by 207 species and Indo-Malayan by 272 species.

From Table 1 (showing the percentage of floristic elements) it is seen that the Perso-Arabian element first decreases from west to east up to the Eastern Rajasthan Uplands and then again increases in Madhya Bharat Plateau, followed by a subsequent decline in the Malwa Plateau. The Indo-Malayan element decreases from east to west, the trend being broken by a sharp increase in the Aravalli region.

Table 1
THE VARIATION OF PERSO-ARABIAN AND INDO-MALAYAN ELEMENTS IN THE DIFFERENT GEOGRAPHICAL REGIONS
(PER CENT OF INDIGENOUS SPECIES IN GEOGRAPHICAL REGION)

Floristic element	Marusthali	Bagar	Aravalli ranges	Eastern Rajasthan Uplands	Madhya Bharat	Malwa Plateau
Indo-Malayan	10.41	12.14	16.91	17.53	16.01	18.32
Perso-Arabaian	17.26	16.94	10.20	8.06	13.05	8.62

Geographical regions of Rajasthan - Source: S. Sharma *in litt.*

The Perso-Arabian element is dominant over the Indo-Malayan element in the region west of Aravallis. In the Aravallis and the eastern region, the proportion of the eastern element (Indo-Malayan) exceeds that of the western element (Perso-Arabian). It follows that the line of demarcation between the Perso-Arabian and Indo-Malayan elements runs along the western flank of the Aravallis.

Drude's line marks the limits of the two floristic elements (eastern and western), it does not represent the 1:1 ratio zone for these elements. In fact, it has been observed (Sharma 1967), that this zone is a place of confluence of the Perso-Arabian and Indo-Malayan elements. the Indo-Malayan element dominates the moist shady habitats and the western element colonizes the sandy habitats within the same general area.

Though not using the phrase 'Drude's line', Burkill's (1924), following remark about a line restricting the Malayan element, suggests that this line has been shifting with climatic changes in the past:

> ..... and now his (Hooker's) new figures suggests another line, say from southern Gujarat to Nepal Himalayas sagging southward in the centre line that under increasing dryness might sag right to the south of India, restricting without driving out the flora, which Hooker calls 'Malayan' .... If that line at one time sagged enough on the map for this and the patanas of Ceylon suggest that it did - it has retreated as well as advanced.

Singh (1977) has stated that several plants of Afro-Arabian origin have recently invaded the western desert. He further opines that in the near future the western element would be recorded in higher percentage from eastern Rajasthan.

A similar view has been expressed by Mani (1974) regarding the faunal affinities of the region. While discussing the Western Borderlands, he states:

> "This transition has been gradually shifting and fanning out eastwards and is at present practically at the Aravalli strike in the Indo-Gangetic Divide."

The combination of progressive dessication (Randhawa 1945) and biotic interference in this region is likely to result in a shift of Drude's line.

However, the location of Drude's line along the Aravallis has been reaffirmed for the extant flora of the area under study.

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39. *NEANOTIS LANCIFOLIA* (HOOK. F.) LEWIS - AN ADDITION TO THE FLORA OF ANDHRA PRADESH

(With a text figure)

While working on the Flora of Andhra Pradesh we collected a specimen of Rubiaceae which we found difficult to identify. We sent the specimen to Kew where Mrs. Diane Bridson identified it as *Neanotis concanensis* Daniel & Vajravelu with a remark 'the small seeds stick together in a mass to resemble one larger single seed'. The identification was later confirmed by Prof. V.V. Sivarajan of Calicut University. When we examiend the literature we found some nomenclatural confusion.

All the 14 species of *Anotis* DC. originally included in that genus by de Candolle are referable to an earlier valid genus, namely *Arcytophyllum* and a few others which are distinctly native to New World. None are associated with the Asian genus *Anotis auct.* Therefore W.H. Lewis (in Ann. Missouri Bot. Gard. 53: 32. 1966) proposed a new generic name *Neanotis* for the related but distinct species indigeneous to Asia and transferred all such species (including Indian taxa) to his new genus.

The very name *Hedyotis lancifolia* Dalz., 1850 is preoccupied by a different plant named by Schumm. & Thonn. 1827. Hence it is not available for the plant under *Anotis* DC. *Neanotis concanensis* Daniel & Vajravelu is a superfluous name, since they cited Dalzel's basionym instead of Hook. f.'s *Anotis lancifolia*. W.H. Lewis has validly published the combination based on *Anotis lancifolia* Hook. f. which is the next available name for the plant as basionym. Hence the name *Neanotis lancifolia* (Hook.f.) W.H. Lewis is correct.

Gamble has not reported even a single species of *Neanotis* from the region which is now called as Andhra Pradesh. Later Rolla Rao and Hara Sreeramulu (1986) reported *Neanotis calycina* from Srikakulam district.

There are two specimens of this species at CAL, one collected by V. Narayana Swamy and Party from Rampa hills of east Godavari district and another by N.P. Balakrishnan collected from Sunkarimetta of Araku in Visakhapatnam district.

Bir Bahadur (quoted from Rao *et al.* 1983) reported the occurrence of *Neanotis montholoni* (Hook.f.) Lewis from Nizamabad district. Pullaiah *et al.* (1992) also reported the occurrence of *N. montholoni* from Adilabad district.

Fig. 1. *Neanotis lancifolia* (Hook. f.) Lewis
A. Twig; B. Flower; C. Calyx; D. Corolla; E & F. Stamens front and back view; G. Pistil; H. Fruit; I & J. Seed front and back view.

Our collection of *Neanotis lancifolia* (Hook.f.) Lewis is the first from Andhra Pradesh. Gamble reported the occurrence of this species from the Western Ghats in the hills of Mysore. The present report extends its distribution. With the present report of *N. lancifolia* the genus *Neanotis* is represented by three species in the State of Andhra Pradesh. Since this species is of rare occurrence and it may occur in the intervening region a citation description and illustration is given for its easy identification.

Neanotis lancifolia (Hook.f.) Lewis in Ann. Missouri Bot. Gard. 53: 59. 1966. *Anotis lancifolia* Hook. f. Fl. Brit. India 3: 73. 1880; Gamble, Fl. Pres. Madras 605 (427). *Hedyotis lancifolia* Dalz. in Hook. J. Bot. 2: 135. 1850 non Schumm. & Thonn. 1827. *Neanotis concanensis* Daniel & Vajravelu in J. Econ. Tax. Bot. 3: 675. 1982.

Erect annual herb, diffusely branched, 30 cm tall; stems and branches sparsely hairy. Leaves membranous, 3-5 x 0.6-1.5 cm, ovate-lanceolate, green, sparsely hairy on the above and paler and hairy on the nerves beneath, base acute, margin entire, acuminate at apex; stipules pubescent, shortly bristly. Flowers purple in terminal and axillary cymes; calyx lobes 4, 2 mm, lanceolate, hairy; corolla lobes 4, 2.5 mm, tube short, 2 mm, triangular-oblong; stamens 4, 0.75 mm, on the mouth of corolla, included; ovary 1 mm, style filiform, 3.75 mm, stigmas 2, linear, 1.25 mm. Capsules compressed, 4 x 2 mm, broad, much broader than long; seeds 2 x 1.5 mm, ellipsoid, convex on the back, pitted, black. (Fig. 1).

Rare, in moist locations in Adilabad district.

Fl. & Fr.: October-December. Sone (Adilabad), *T. Pullaiah & P.V. Prasanna* 4029 (K & SKU).

21 July, 1993

M.S. GAYATHRI
T. PULLAIAH
P.V. PRASANNA

Department of Botany, Sri Krishnadevaraya University, Anantapur 515 003, A.P.

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Pullaiah, T., P.V. Prasanna & G. Obulesu (1992): Flora of Adilabad district, Andhra Pradesh, India. Delhi.

Rao, P.N., V.S. Raju & R.S. Rao (1983): Floristic Research work in Andhra Pradesh. *Bull. Bot. Surv. 23:* 90-95.

Rao, S. Rolla & Sreeramulu, S. Hara (1986): Flora of Srikakulam district, Andhra Pradesh, India. Meerut.

40. *PULICARIA FOLIOLOSA* DC., A NEW DISTRIBUTIONAL RECORD TO PENINSULAR INDIA

(*With a text-figure*)

While exploring the flora of Nizamabad district, Andhra Pradesh, India we collected a rare taxon belonging to the family Asteraceae which was identified as *Pulicaria foliolosa* DC. The species in the Gangetic plains and Central India (Hook. 1881, Rao *et al.* 1988) and has not been reported from Peninsular India so far. Hence the present report extends its distribution to Peninsular India.

The taxon is easily distinguishable from other species of the genus *Pulicaria* in having capitula with tubular ray florets and mostly spathulate leaves.

Citation, detailed description, lillustration and phenological data are provided to enable easy identification.

Pulicaria foliolosa DC., Prodr. 5:480. 1836; Hook. f., Fl. Brit. India 3: 298. 1881.

Exact annual herb, to 40 cm. Root stock woody, stem striate, pubescent, branchlets villous. Leaves alternate, sessile, oblong, oblanceolate-spathulate, 2.0-7.5 x 0.1 - 1.5 cm, sparsely scabrid, base narrowed, amplexicaul, apex apiculate, recurved, obscurely serrulate. Capitula solitary or few, to 5 x 6 mm, terminal, heterogamous, pedunculate; peduncles with multicellular hairs and minute sessile glands. Involucre campanulate. Phyllaries linear, 3-seriate, not exceeding the florets, acute; outer ones to 3 x 1 mm, covered with multi-cellular hairs and sessile glands; inner ones to 5 x 2 mm, sparsely hairy with densely segregated colleters and sessile glands. Receptacle to 5 mm across, pitted. Outer florets female, inner ones bisexual. Pappus 2-seriate, outer forming a fimbriate cup, inner 4-7 minutely setose. Bisexual florets: up to 260 in number, tubular, glabrous to 4 mm; lobes 5, deeply cleft, triangular covered with colleters, acute, papillate. Stamens 5, subexserted; anther linear, to 2 mm, base tailed, tails unequal, longer than the thickened portion of filament, often branched, hood gradually narrow, acute. Ovary elliptic-oblong, style to 3 mm, subexserted, bifid; stigma minutely muricate, acute. Female florets: up to 180 in number, tubular, 3-lobed, lobes covered with colleters, acute, papillate. Achenes elliptic-oblong, to 1 mm, puberulous with unicellular hairs.

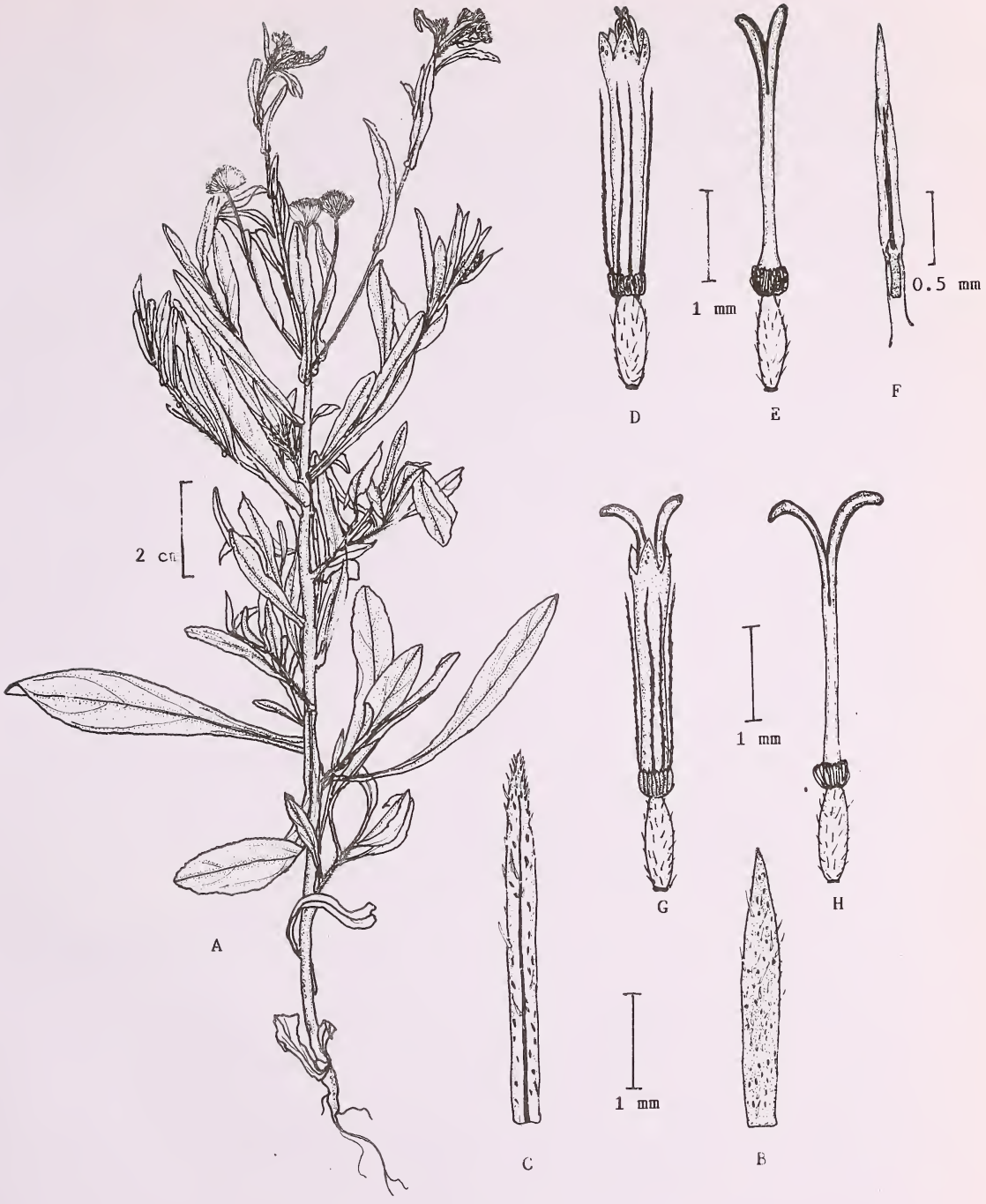

Fig. 1. *Pulicaria foliolosa* DC.
A. Twig; B. Outer involucral bract; C. Inner involucral bract; D. Bisexual floret; E. Bisexual floret - Gynoecium; F. Anther; G. Female floret; H. Female floret - Gynoecium.

Occasional in moist locations especially along the river banks in Nizamabad district (Andhra Pradesh).

Fl. & Fr.: September-March.

Representative specimen: Kandakurthi (Godavari River banks), *B. Ravi Prasad Rao* Acc. No. 7251.

ACKNOWLEDGEMENT

One of us (BR) is grateful to University Grants Commission, New Delhi for financial assistance.

September 2, 1993

C. PRABHAKAR RAJU
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R.R. VENKATA RAJU

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BOMBAY NATURAL HISTORY SOCIETY

Hornbill House, S.B. Singh Road, Bombay 400 023

109TH ANNUAL REPORT AND ACCOUNTS FOR THE YEAR 1ST APRIL 1992 TO 31ST MARCH 1993

EXECUTIVE COMMITTEE FOR 1992-93

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Vice Presidents Mr. Humayun Abdulali (Dec. 1992)
Mr. Kisan Mehta (Dec. 1992)
Ms. D.S. Variava
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Hon. Secretary Dr. (Ms) Meena Haribal (22-12-92)
Mr. J.C. Daniel (From 28-12-92)
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The Director of Archaeology & Museums, Govt. of Maharashtra
The Secretary, Ministry of Environment & Forests, Govt. of India

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AUDITORS

M/s Habib & Company, Chartered Accountants, Bombay 400 003

BOMBAY NATURAL HISTORY SOCIETY
ANNUAL REPORT FOR THE YEAR ENDED ON 31ST MARCH 1993

MEMBERSHIP

The membership for the year 1992-93 were as follows:

Type of Membership	1990	1991	1992
Ordinary (Indian)	1584	1584	1527
Student	308	416	403
Life (Indian)	1148	1261	1305
Corporate	75	75	32
Compound Corporate	113	113	111
Family	-	46	57
Ordinary (Foreign)	140	54	15
Life (Foreign)	210	213	211

The membership particularly of ordinary members has stagnated at about 1500. This is now receiving the serious attention of your Committee. Your assistance and advise on this account would be welcome.

MEMBERS PROGRAMMES

Annual Nature Camps

One of the main field activities of the Society greatly appreciated by Members are the camps. It is often difficult to accommodate all interested members. This year, Annual Nature Camps were arranged at Panwali in the Garhwal Himalayas, Ranthambore National Park and Keoladeo National Park, Namdapha National park, Arunachal Pradesh and Little Rann of Kutch.

Overnight Camps

Overnight nature camps are unfortunately available only for Bombay members. We shall in future try through members elsewhere to arrange for overnight outings for our members in other parts of the country. The organisation of such programmes is under consideration.

Overnight weekend camps were arranged at Mahuli Fort, Rehkuri near Pune, Tansa Wildlife Sanctuary, Malshej Ghat, Bhimashankar Wildlife Sanctuary, Nane Ghat, Raigad and Torna, Panchgani and Dapoli

Weekend Outings

Weekend outings were largely nature conservation and wildlife preservation awareness outings. The areas visited on weekends were Borivli National Park, Yewoor and Nagla Trail, Karnala, Kankeshwar, Dharamtar and Goregaon creek, Vihar lake. Outings were arranged to Godrej land to see mangrove flora and fauna and to Borivli National Park for monsoon flora. A seashore outing was arranged to see coastal marine fauna. The monthly bird count programme was arranged to monitor resident and migratory birds of the Borivli National Park.

Weekend outings are also one of the programme that require wider dissemination. Such outings need to be organised in different parts of the country.

Bird Banding Programme

One of the major activities of the BNHS has been the ringing of migratory and other species of birds in various parts of the country. This programme was started in 1959 by Dr Salim Ali and we have now ringed over 3 lakh birds of over

200 species. The recovery of our ringed birds in Russia and elsewhere have shown us the movements of migratory birds between India and countries to the North. It is now necessary to extend this programme and we held bird banding training camps for members so that a larger number of trained individuals will be available for field work in this very useful field programme.

Film/Slide Shows

Several video and 16 mm films on wildlife and nature were screened for members. Slide shows and talks on a wide variety of subjects like monsoon flora; trek to Rara lake in Nepal; rare birds of Brahmaputra valley; Rio Conference; wildlife protection act and its implementation; why conserve bats?, Oceanic expedition; Asian elephants; butterflies and how to study them? were arranged during the year.

Dr Gren Lucas, Deputy Director, Kew Botanical Garden gave a lecture on Kew Botanical Garden in 21st Century, and Dr Roger Clarke, a Visiting Scientist from the Owl & Hawk Trust gave a lecture on Birds of Prey - Harriers.

A panel discussion on recently launched Project Elephant was arranged. The talk "Arunachal pradesh, a ravaged frontier" brought out conservation issues. Environment Awareness week was organised jointly with Max Muller Bhavan, Bombay. Films on environment, pollution, etc., followed by panel discussions by eminent environmentalists were arranged.

World Environmental Day and Wildlife Week

Wildlife Week was celebrated and public awareness programmes like Quiz for children, know your trees, and panel discussions on current subjects were arranged. Slogan competition on "Save the Earth" was arranged jointly with British Council, Bombay Division.

Exhibition

Wildlife Photograph Exhibition: "Beautiful People", a one man show of nature and wildlife photographs was arranged by Mr Hemendra Shah, a BNHS member and photo journalist from Ahmedabad. The exhibition was inaugurated by His Excellency the Governor of Maharashtra.

Bird Stamps Exhibition: An exhibition of postal stamps on birds was organised on 12th November to celebrate the 96th birth anniversary of the late Dr Salim Ali. Mr N Chaturvedi and Mr Farrukh Shah displayed birds stamps on the occasion.

Release of postal stamps on Birds of Prey: The release of a set of four stamps depicting of Birds of Prey was held at Hornbill House. The Governor was the Chief Guest on this occasion. The Post Master General, Maharashtra, presided. Mr. J.P. Irani, a life member of the Society, also well known for painting birds, was honoured by the Society on this occasion.

We thank the Forest officials specifically Mr Walke for allowing us to conduct some educational programmes at Borivli National Park; the In-charge of Godrej Park; Film Librarian — British Council and other officials connected with "Save the Earth" slogan competitors; the Governor's Secretariat for arranging the Governor's visit to BNHS, the Director and officials of Max Muller Bhavan and forest officials connected with National Parks and Sanctuaries where our nature camps were held. The Chief Wildlife Warden, Tamil Nadu for permitting us to conduct Bird Banding Programme.

SALIM ALI NATURE CONSERVATION FUND

Research Projects Funded

1. The following two research projects were funded under a special scheme to assist scientists of the Society:

a. "An Ecological Investigation of the Avian Community of the Sriharikota Island" - Prakash Rao
b. Conservation Perspectives of Pulicat Lake with Respect to its Avifauna" — K.K. Mohapatra.

2. A small project for studying the Kanakeshwar Hills near Kihim, one of the favourite spots of Dr. Salim Ali, was initiated to find ways for better preservation of the temple forest.

Reports

1. **Large Dams Project:** *Kalpavriksha* has submitted a preliminary report on one (Ukai in Gujarat) of the three sites studied under the SANCF supported project for "Post Construction Evaluation of Large Dams". A Comprehensive report is under preparation.

2. **Pooyamkutty:** The report on Pooyamkutty in Kerala, undertaken by R. Sugathan, is critical of the proposed dam. Beside, destruction of tropical moist deciduous and semi evergreen forests including their reed brakes, the dam may lead to local extinction of some endemic flora and fauna of the region. The reservoir will also interfere with migration of terrestrial animals. Displacement and loss of reed and bamboo area will adversely affect the local human population. BNHS is trying to create public awareness against this and other large dams in the country.

3. **Bhimashankar:** The final report of the Study on the Wildlife — People Conflict in the Bhimashankar Wildlife Sanctuary by Renee Borges and Ulhas Rane was received. Beside other issues, the Society has taken up the case of *Karvi* exploitation from the sanctuary with the authorities.

4. **The Dangs:** Reports of the following two projects undertaken by E.K. Bharucha and Sejal Worah partly funded by SANCF were received: (i) The Ecology and Management of Fragmented Forests in the Dangs, South Gujarat, India. (ii) Forest and Land Use Survey of the dangs, Gujarat - Using low level systematic aerial reconnaissance (with W.A. Rodgers).

Other Environmental Issues

1. *Narmada:* SANCF continued its support to the movement against damming Narmada and meetings of the environmental activists were regularly organised at Hornbill House.

2. *Nagarhole and Manas:* The Society joined others in condemning burning of Nagarhole National Park in Karnataka and destructive activities at Manas Wildlife Sanctuary in Assam and started a campaign against these activities.

Networking and Documentation

SANCF maintained contact with several environmental NGOs and government departments of the country.

The activity of SANCF, particularly its environmental workshops for the officers of the Indian Army, were presented at the IUCN sponsored workshop on South and Southeast Asia Network for Environmental Education (SASEANEE) held at CEE, Ahmedabad, from 10 to 12 February 1993.

A workshop on Human Right, Environment and Law was planned at Bangalore in June 1993 by the Bombay based Human Rights Law network. BNHS is one of the co-convenors of the workshop.

Seminars, Training Workshops and Lectures

1. Environment and Nature conservation Workshops for the Indian Army: Three workshops for the officers of the following Commands were organised.

a. Southern Command, 16 to 23 June 1992. NDA, Khadakvasla.

b. Northern command, 15 to 21 October 1992, Palampur (H.P.).

c. Western Command, 13 to 19 November 1992, Kota.

The main aim was to train the officers for spreading the message of nature conservation among the ranks and file. They were also encouraged to take up local environmental issue at the place of their posting. About 40 officers from different units of the respective commands attended each workshop beside resource persons from BNHS, Army and local institutes.

2. Environmental Workshop for Social Communication Media Students of Sophia Polytechnic, Bombay, was organised on 21 and 22 September 1992 at the Society.

3. Bombay Earth Forum: A week long programme of talks, film shows, debates, exhibitions etc. was organised in collaboration with the British Council Division, British Deputy High Commission, Bombay during the 1992 wildlife week.

4. Lectures: Dr. Amotz Zahavi, the renowned behavioural scientists from Tel Aviv University,

delivered the Salim Ali Lecture on "Messages in Bird Displays" on 7 September 1992. Two lectures on "Biodiversity", one by Mr David Ferguson of US Fish & Wildlife Service on 29 May 1992 (jointly with USIS) and other by Mr. Ashish Kothari of *Kalpavriksha* on 1 February 1993, were organised.

NATURAL HISTORY STUDIES

Three major projects were funded namely: "Survey of Reptiles in Sanjay Gandhi National Park, Borivli" by Mrs Gitanjali Hora for a period of nine months in 1992-93. The main objectives of her study are (1) to prepare a checklist of the existing reptile species along with their crude abundance in the study area, (2) to correlate reptile species diversity with disturbance in the study area, (3) to compare the reptile species richness and habitat indicator species, extinct or nearly extinct species and potential species for reintroduction in the study area. A total of 31 species of reptiles (which includes 11 species of lizards, one species of turtle and 19 species of snakes) were identified to occur in the Sanjay Gandhi National Park based on the study conducted by her from 7th February to 8th June 1993.

The second: "Ecology of Amphibians of Northern Western Ghats, with special reference to the Sanjay Gandhi National Park, Borivli, Bombay" for a period of two years from 1993 to 1995 was by Mr. A.G. Sekar. The main objectives of his study are (1) to study the species richness, relative abundance and species diversity of amphibian fauna of the study area, (2) to study the habitat and microhabitat preference by the amphibian fauna of the study area, (3) to study the biometrics of the breeding populations for certain species and (4) to study the breeding biology of amphibians of the study area. The work on indepth study on eight species of amphibians is in progress.

The third project was on "Insect Fauna of the Borivli National Park" by Mr N. Chaturvedi. Documentation of Insect fauna of Borivli National Park which started in November 1990 is continuing. Several aspects of the ecology of species of butterflies such as seasonal population, feeding and migration were studied. Bugs and ants were studied in detail. The final report is expected after the study is over.

In addition financial assistance was extended to members and staff to attend seminars and conferences namely for Mr V C Ambedkar to attend Maharashtra Pakshi Mitra Sammelan at Nagpur, Mr A G Sekar to attend the International Conference on Amphibia and Reptiles at Bhubaneshwar and to Mr Manoj Muni to participate in the International bat Research Conference at Madurai.

PROJECTS

During the year, the BNHS handled 13 major and minor projects and surveys. The progress of research work under each of these projects is detailed below:

1. **Birds of Prey Project**
   Scientist In-Charge: Dr Vibhu Prakash

A 3 month extensive survey of raptors in the wildlife sanctuaries all over India was conducted by 2 teams of scientists. The main states covered were Goa, Maharashtra, Karnataka, Madhya Pradesh, Uttar Pradesh, Orissa and West Bengal. Gujarat, Ladakh and Andaman & Nicobar islands were also covered. Breeding biology of raptors was undertaken in Corbett National Park, but could not be completed due to terrorist problems in the area. A static camp was established at Anaimalai Sanctuary and endangered target species were studied up to March 1993. The tenure of the project ended in March 1993 but writing of the report was undertaken up to June 1993 on No Cost Extension basis. U.S. Advisor, Mr William Clark joined the survey team to the Andamans.

2. **Grassland Ecology Project**
   Scientist In-Charge: Dr A.R. Rahmani

Research under this project is continuing in collaboration with AMU. Field stations were established at Dahod (Gujarat), Nannaj (Maharashtra), Rollapadu (Andhra Pradesh), Dudhwa (Uttar Pradesh) and at Fulay-Chhari (Kutch). U.S. Advisor, Prof. Mark Behen visited Dahod and Nannaj field stations.

3. **Bird Migration Project**

Scientists In-Charge: Dr S. Balachandran

Work on this project concluded in July 1992. Executive Summary of the final report is being prepared.

4. **Elephant Ecology Project**

Scientist In-Charge: Mr Ajai Desai

Project ended in September 1992. Annual Executive Summary was prepared and copies were given to U S Advisors during the Research Advisory Panel meeting in November 1992. Final Technical Report is awaited.

5. **Elephant Ecology (Radio Telemetry) Project**

Scientist In-Charge: Mr Ajai Desai

Radio Telemetry Study of elephants was a part of the Elephant Ecology Project. This study was continued from October 1992 onwards in collaboration with SACON. SACON funded the study for 6 months from October 1992 to March 1993. a report on capturing and radio collaring of elephants and a progress report on telemetry studies for the period October 1992 to December 1992 has been submitted. A summary report for SACON for the period October 1992/March 1993 is awaited.

6. **Point Calimere Ecology Project**

Scientist In-Charge: Dr Y N Rao

This project ended in June 1991. A draft final report was sent to the funding authorities for comments from Advisors. The second half of the final technical report has been prepared.

7. **Bird Hazard Research Cell**

Scientists In-Charge: Dr Robert B Grubh
Dr S M Satheesan

The work of the Bird Hazard Research Cell included:

i) Identifying Bird Strike Remnants from both Military and Civil Aviations.

ii) Giving advice and guidance to aviation authorities and reducing bird menace.

iii) Offering advice and guidance to aviation personnel and attending bird strike committee meetings.

The BNHS conducted a Bird Strike Prevention Training Course for aviation officials at Delhi from 23rd to 28th July 1992. A report of this training course has been prepared. Extension to the BHRC has been granted by the funding agencies.

8. **Environmental Impact Assessment (EIA)**

Scientist In-charge: Dr Robert B. Grubh

Environmental Impact Assessment study was conducted at the site of the proposed Lignite mining at Barsingar (Rajasthan) for Neyveli Lignite Corporation Ltd. The study period was from November 1991 to August 1992. A report incorporating the relevant findings and pertinent recommendations has been prepared.

9. **Endangered Turtles of Pondicherry**

Scientist In-charge: Dr. S Balachandran

This study has been initiated to record different species of turtles found along the coast of Pondicherry, to educate/inform people living in this coastal area and initiate conservation measures and also to provide protection to nests and nesting sites in collaboration with the Department of Animal Husbandry, Government of Pondicherry. The study started in December 1992 and is to continue till August 1993.

10. **Bird Communities of Sriharikota**

Scientist In-Charge: Mr Prakash Rao

This ISRO funded project has the following objectives:

- To investigate the avian community of Sriharikota Island and its habitat types.
- Documenting the movement, distribution and behaviour of birds within the island, in relation to biotic and abiotic factors.
- To study the winter migration of birds.
- To investigate the exotic plantations occurring within the island and its probable impact on the avian community. The study started in January '93 and will continue till 1994.

11. **Harrier Project**

Scientist In-Charge: Mr. Asad Akhtar

Sponsored by the Hawk and Owl Trust, UK, to study roosting harriers at Velavadar National Park (Gujarat). Study was started in November 1992. Duration of study 6 months. 2 naturalists from U.K. who sponsored this project visited Velavadar National Park.

12. **Study of Bats**

Scientist In-Charge: Mr Manoj Muni

Sponsored by the Harrison Zoological Museum, U.K. This survey was for a short period from 4th March to 12th April 1993. During the survey the team members found the rare species of bat, *Latidens salimali.*

13. **Wetlands of India**

Scientist In-Charge: Dr Jay Samant

This short term project funded by UNDP and sponsored by Ministry of Environment and Forests, Government of India, was to recommend strategy for conservation of wetlands, mangroves, and coral reefs in India. Preliminary draft recommendations has been submitted to MOE, GOI.

UNIVERSITY STUDIES

The University department which started functioning in 1957 is likely to have its quota of student registration increased for research in Zoology. The Botany section which came into existence in 1989, is being considered for permanent recognition by the University.

The details of the students who qualified or are working for a higher degree are given in Table.

NATURE EDUCATION

The Nature Education Scheme of the Society which was started in 1948 continued to be active covering Kalyan and Ambernath and Teachers' Training Colleges in Bombay.

During the year approximately 8000 students took advantage of our different activities. Apart from students nearly 200 trainee teachers participated in our training programme for environmental education.

Our programmes also covered rural areas of Maharashtra as well as personnel of the Army and Navy.

In addition to routine activities the World Forestry Day was celebrated with a quiz programme. Eighteen schools participated and students of Girton High School won the competition while the students from A.K. Joshi High School, Thane and Bharda New High School, Bombay were joint runners up.

An Environment Awareness Course with the theme "Ponds and Forests for Prosperity and Posterity" was conducted in January 1992 for college lecturers and professors from Kanyakumari district in Tamil Nadu. A detailed report was prepared and copies were sent to the Collector, Kanyakumari district, Tamil Nadu; DFO, Kanyakumari district and other active resource persons.

Interaction with Scouts

Ten students from 10th standard were examined for the proficiency badges (friends to animals) and a talk illustrated with slides on "Our Wildlife" was arranged for the scout and guide instructors at their headquarters.

The NEO assisted in the camps organised by the YWCA, the Society for Clean Cities, Institute for the Psychologically Handicapped and the Swami Vivekananda Kendra.

Field Trips

In all 37 field trips to Borivli National Park, two to Karnala, two to Yewoor and three to Nirje, Dombivli were conducted during the year. Among these 5 were for college students, 3 for trainee teachers and remaining were for school students of 8 to 12 std. About 30/35 students were taken in each batch. Two field trips to Manori beach were arranged for shore life study.

Teaching through Exhibits

Children of 6th to 8th std. were taken to the Zoo, Museum and Aquarium during the year. Seventeen visits to Prince of Wales Museum, six visits to Victoria Garden and eight visits to Taraporewala aquarium were arranged.

Extension of Activities

During the year 4 new schools were introduced to the BNHS nature education activities. Among these 2 were from Vashi, New Bombay. Talks illustrated with slides were arranged in other schools and colleges.

Table

Students	Degree	Guide	Subject
A. Students who qualified			
1. Mr. Goutam Narayan	Ph.D.	Mr. J. C. Daniel	Ecology, distribution and conservation of the Bengal Florican *Houbaropsis bengalensis* Gmelin in India
2. Mr. Ranjit Manakadan	Ph.D.	"	Ecology of Flamingoes at Point Calimere, S. India.
3. Mr. Shahid Ali	M.Sc. (By Research)	"	Ecology and behaviour of Grey Francolin
B. Students who have submitted thesis			
1. Mr. N.K. Ramachandran	Ph.D.	Dr. V. S. Vijayan	Comparative Ecology of the Pheasant-tailed and Bronzewinged Jacanas in Keoladeo National Park, Bharatpur, Rajasthan.
2. Mr. Gurmeet Singh	M.Sc. (By Research)	Dr. R.B. Grubh	The Ecology of the Bank Myna *Acridotheres ginginianus* (Latham) in an urban environment
3. Students continuing research			
1. Mr. Bharat Bhushan	Ph.D.	Mr. J.C. Daniel	Birds of Eastern Ghats
2. Mr. Prakash Rao	Ph.D	"	Bird Communities of Tropics Dry Evergreen Forests of Sriharikota Island
3. Mr. N. Chaturvedi	Ph.D.	"	Ecology of butterflies of the Borivli National Park
4. Mr. Alagar Rajan	Ph.D.	Dr. R.B. Grubh	Avifauna of Tropical Dry/ Evergreen Forests of Point Calimere
5. Mr. P.D. Vivek	M.Sc. (By Research)	"	Birds of Delhi Ridge
6. Ms. Nikita V. Mathur	M.Sc. (By Research)	Mr. J.C. Daniel	Some rare raptors breeding at Bharatpur
7. Ms. Neelam Patil	M.Sc. (By Research) in Botany	Mr. M.R. Almeida	Plant insect interaction
D. New registrations			
1. Mr. Asad Akhtar	Ph.D.	Mr. J.C. Daniel	Ecology of Harriers wintering in India
2. Mr. Satish Kumar	Ph.D.	Dr. Jay Samant	Prey predator relationship in the grasslands of Nannaj.

Meetings, Workshops

The NEO collaborated with the Indian Institute of Education, Pune, in the production of literature for rural people. The NEO also attended SASEANEE Workshop organised at the Centre for Environmental Education (CEE), Ahmedabad.

COLLECTIONS

MAMMAL Mr. Manoj Muni, In-Charge, Mammals.

A collaborative project on resurvey of 'Mammals of India" was continued with the scientists of Harrison Zoological Museum, UK. Areas like Madras, Madurai, High Wavy's Mountains, Mysore, Srirangapattam, Goa, Sirsi, Jog and Gersoppa in south India and Nainital, Haldwani, Rhishikesh, Dehradun, Mussoorie, Delhi and Agra in north India were surveyed with Dr Paul Bates, Dr David Harrison and Ms Nicky Thomas of HZM. The representative collection of bats was made from each of these areas and notes on their present status was collected.

During the last week of the expedition in Madurai District, Tamil Nadu, Salim Ali's Fruit Bat, *Latidens salimalii* was rediscovered. This bat was discovered after a gap of 45 years and is recorded in the Guiness Book of World records as one of the three rare fruit bats of the world.

Two individual projects of the titles 'Chemotaxonomy of Indian Bats' and 'Hair structure study of Indian mammals' were continued.

Under the first project, blood samples obtained from the bats collected during the Mammal Survey of India project conducted in March 1992, were analysed electrophoretically and the haemoglobin protein profiles were prepared for the individual animals. While under the second project, standard catalogue of hair slides of the Indian Felidae was prepared.

The computerisation of the card-index data was continued. In all 13000 records completed. Preparation of a status report on the mammal collection was undertaken. In all, checking of 6000 animals was completed.

Publications: A paper on 'The Bats of Western India revisited' by Dr Paul Bates and Dr David Harrison of HZM and Manoj Muni of BNHS has been submitted for the publication in the JBNHS.

BIRDS Dr (Mrs) Unnithan, In-Charge, Birds.

The cataloguing of the Collections by Mr Humayun Abdulali was continued, Part 35 of the catalogue dealing with Traglodytidae, Cinclidae, Prunellidae, Paridae, Sittidae and Certhidae was published in JBNHS 89(1), April 1992. This part covered 866 specimens of 88 species and subspecies. In the same journal an article titled "Plumages, female dimorphism and polymorphism of the endemic Indian species *Parus xanthogenys* and a detailed study was done on the *Nectarina jugularis* (olive backed Sunbirds) from different islands of Andaman and Nicobar.

Herpetology Mr. Aloysius G. Sekar, In-Charge, Herpetology.

(a) About 62 specimens of 19 species donated by Dr. R.J. Ranjit Daniels were registered. This included the rare toad *Ansonia ornata*, a new addition to the Collection. (b) another noteworthy addition was of the snake *Uropeltis macrolepis* collected by Mr. M.R. Almeida.

A list of type specimens in the collection has been prepared and Collection data of 500 specimens have been entered in the computer.

Research: (a) A short term project has been undertaken to study the frogs and toads of Sanjay Gandhi National Park, Borivli. (b) Experiments were done to determine the food requirements of developing tadpoles of the Indian Burrowing Frog *Tomopterna breviceps*.

Publications: (a) 'Key to the amphibian fauna of Goa' - Herpeton. (b) 'Habitat and microhabitat utilisation of amphibian fauna of Goa during monsoon'— Indian journal of Forestry (in press). (c) 'Occurrence of Cantor's Black headed snake *Sibynophis sagittarius* in Sriharikota, Andhra Pradesh' and 'Range extension of the Bombay Shield-tail snake *Uropeltis macrolepis*' JBNHS (in Press). Seven papers were evaluated for the Journal of BNHS.

ENTOMOLOGY Mr. N Chaturvedi, In-Charge, Insects.

Life cycle of moth feeding on crinum lily was worked out and moth was identified as of *Polytela graciosa*. Tags to study butterfly migration were put on 300 Danaid butterflies. Information on *Papilo* butterflies was sent to Dr Rose of Punjab University, Assistance was given to students of Institute of Science and Sophia College in identification and studies of insects. Also assistance was given to CRY to design and prepare products depicting butterflies. Insects received from the Grassland Project, Dahod fieldstation were identified.

Publications: A note on new larval food plant was published in the Journal of Tropical Lepidoptera. A note on gynandromorph of Indian Sunbeam *Curetis thelis* was published in Tropical Lepidoptera Newsletter. A note on cannibalism in butterfly larvae; Northward migration of *Euploea, core* (Cramer), Common Indian Butterfly in and around Bombay was published.

HERBARIUM Ms Neelam Patil, In-charge, Herbarium.

Specimens added to the collections: 96 specimens of Bharatpur and 47 specimens of Borivli National park were added to the collection after properly poisoning. The entire collection was rearranged according to the Bentham and Hooker's classification. A computerized list of plants of Maharashtra region, present in the BNHS Collection was prepared.

PRODUCTS

During the year the Products Committee produced 1,88,000 cards of 9 designs. The total number of cards sold was 1,94,000 inclusive of old cards. The department also produced and sold 10,000 desk calendars. (The net earnings were in the range of around Rs. 2.2 to 2.5 lacs).

Besides cards and calendars which are the main items on sale other items include mugs, caps, T-shirts and photographs.

Special thanks are due to Mr Mantosh Lal of We graphics for providing subsidised services for product design. The marketing strategy adopted during the year was mainly by way of despatching catalogues to Corporate houses and contacting people on phone, personal visits, etc.

Efforts are being made to paper for cards and calendars. And most important that we create a name that every person would want to be associated with their corporate gifts.

PUBLICATIONS

The Book of Indian Birds. The Book of Indian Mammals and the Book of Indian Reptiles continued to be the mainstay of the Publications Division of the Society. The Oxford University Press, our sole selling agents, have been successful in promoting the sales of our publications which has made this activity of the Society self supporting and has the potential to be a substantial fund raiser for the Society. This has been appreciated by our Committee and efforts are under way to increase the list of publications.

In addition to reprinting the Pictorial Guide to Indian Birds, a revised and enlarged version of the Bird Book is under preparation. The mammal and reptile books are under revision. A new book on trees as well as books on butterflies and other insects are under consideration.

A series of booklets on various aspects of natural history under the general title of Hornbill Series is under preparation. The mammal and reptile books are under revision. A new book on trees as well as books on butterflies and other insects are under consideration.

The Hornbill and the Journal continue to be a resource drain in spite of their importance, namely the Hornbill to popularize Natural History and the Journal to disseminate the science of Natural History. The Ministries concerned with Science and Environment have unfortunately not been as helpful as they should. We are continuing our efforts to meet the deficits in the publication costs of the two journals.

LIBRARY

The Library continues to be the most used

facility of the Society and an important source of information to scientists, researchers, journalists and students about conservation education, flora and fauna, environment and related matters.

At the end of March 1993, the library collection stands at 11,879 books including bound volumes of periodicals. In 1992, 88 books were added to the library. 10 books were received from the publishers for review in the Journal and 11 as complimentary copies from authors and publishers. 11 books were received as donation and 56 books were purchased for the library and various projects.

The Librarian attended one day workshop at the SNDT on Library Automation and later visited libraries of the Centre for Ecological Sciences at IISc, National Centre for Science Information at IISc., INSDOC Centre at IISc. and the WWF Data Centre for Natural Resources, Bangalore. This visit was mainly to see the working set up of special libraries that are attached to research institutes and which of these libraries could provide information to our researchers.

For book selection, the Sub-Committee members visited bookshops for on the spot selection.

SUB-COMMITTEES OF THE EXECUTIVE COMMITTEE

MEMBERSHIP & PROGRAMME SUB-COMMITTEE

Chairman	Mr.. Sunjoy Monga
Members	Dr. Ashok Kothari
	Mr. T. V. Sowrirajan
	Mr. P.B. Shekar
Hon. Secretary	Dr. (Ms) Meena Haribal (up to 26-12-92)
	Mr. J.C. Daniel (from 28-12-92)
Hon. Treasurer	Mr. C.G. Wakankar (up to 22.12.92)
	Sunil Zaveri (from 23-12-92)
Director	Dr.. Jay Samant
Convenor	Mr.. N. Chaturvedi

SALIM ALI NATURE CONSERVATION FUND SUB-COMMITTEE

Chairman	Dr. Erach K. Bharucha
Members	Mrs. Dilnavaz S. Variava
	Mr. J.C. Daniel (Hon. Secretary Since 28-12-92)
Hon. Secretary	Dr. Meena Haribal (up to 26-12- 92)
Hon. Treasurers	Mr. Chandrakant Wakankar (up to 22-12-92).
	Mr. Sunil Zaveri (from 23-12-92)
Director	Dr. Jay S. Samant
Convenor	Mr Goutam Narayan

NATURAL HISTORY STUDIES SUB-COMMITTEE

Chairman	Dr. Erach Bharucha
Members	Mrs. D.S. Variava
	Dr. Pratap Saraiya
	Dr. B.F. Chhapgar
	Mr. M.R. Almeida
	Dr. A.M. Bhagwat
	Dr. Shashi Menon
	Dr. Parvish Pandya
Hon. Secretary	Dr. (Ms) Meena Haribal (up to 26-12-92)
	Mr. J. C. Daniel (from 28-12-92)
Hon. Treasurer	Mr. C.J. Wakankar (up to 22-12-92)
	Mr. Sunil Zavery (from 23-12-92)
Director	Dr. Jay S. Samant
Convenor	Dr. S.M. Satheesan

PROJECTS SUB-COMMITTEE

Chairperson	Dr A.M. Bhagwat
Members	Mr Humayun Abdulali
	Mr Kisan Mehta
	Adm. M.P. Awati (Retd.)
	Mr. K.P. Karamchandani
	Mr J. C. Daniel
	Dr B.F. Chhapgar
	Dr. Renee Borges
Hon. Secretary	Dr. (Ms.) Meena Haribal (up to 26-12-92)
	Mr. J. C. Daniel (from 28.12.92)
Hon. Treasurer	Mr. C.G. Wakankar (up to 22.12.92)
	Mr. Sunil Zaveri (from 23.12.92)
Director	Dr. Jay S. Samant
Convenor	Mr. S.R. Nayak

UNIVERSITY STUDIES SUB-COMMITTEE

Chairman	Prof. P.V. Bole
Head, Univ. Dept.	Dr Jay Samant (Director)
Members	Mr M.R. Almeida
	Dr. Ashok Bhagwat
	Dr. B.F. Chhapgar
	Dr. Parvish Pandya
	Dr. Shashi Menon
	Mr. J.C. Daniel

	Dr. R.B. Grubh Dr. Renee Borges
Hon. Secretary	Dr (Ms.) Meena Haribal (up to 26.12.92)
Hon. Treasurer	Mr. C.G. Wakankar (up to 22.12.92) Mr. Sunil Zaveri (from 23.12.92)
Convenor	Mr. N. Chaturvedi

NATURE EDUCATION SUB-COMMITTEE

Chairman	Dr. Parvish Pandya
Members	Dr. Arun Joshi Dr. Sanjay Bhagwat Mr. Vilas Shingre Mrs. Shobhana Bijoor Mrs. Sadhana Rasal
Hon. Secretary	Dr. (Ms) Meena Haribal (upto 26.12.92) Mr. J.C. Daniel (from 28.12.92)
Hon. Treasurer	Mr. C.G. Wakankar (upto 22.12.92) Mr. Sunil Zaveri (from 23.12.92)
Director	Dr. Jay Samant
Convenor	Mrs. Shailaja Grubh

COLLECTIONS SUB-COMMITTEE

Chairman	Mr. M.R. Almeida
Members	Dr. B.F. Chhapgar Mr. Andy Mendonca Mr. Oswald Thayil
Hon. Secretary	Dr. (Ms) Meena Haribal (up to 26.12.92) Mr. J.C. Daniel (from 28-12-92)
Hon. Treasurer	Mr. C.G. Wakankar (up to 22-12-92) Mr. Sunil Zaveri (from 23. 12. 92)
Director	Dr. Jay Samant
Convenor	Mr. N. Chaturvedi

PRODUCTS SUB-COMMITTEE

Chairperson	Mrs. D.S. Variava
Members	Mr. Sunjoy Monga Mr. Mantosh Lal Mr. Atul Mathur Mr. Pritish Basu Mrs. Ranjana Shah
Hon. Secretary	Dr. (Ms) Meena Haribal (up to 26.12.92) Mr. J. C. Daniel (from 28.12.92)
Hon. Treasurer	Mr. C.G. Wakankar (up to 22.12.92) Mr. Sunil Zaveri (from 23.12.92)
Convenor	Mr. J. Rodrigues

PUBLICATIONS SUB-COMMITTEE

Chairman	Mr. J. C. Daniel
Members	Dr. Pratap Saraiya Mr. Bittu Sahgal Mr. Sunjoy Monga Dr. B.F. Chhapgar
Hon. Secretary	Dr. (Ms) Meena Haribal (up to 26.12.92) Mr. J.C. Daniel (from 28-12-92)
Hon. Treasurer	Mr. C.G. Wakankar (upto 22.12.92) Mr. Sunil Zaveri (from 23.12.92)
Director	Dr. Jay Samant
Convenor	Mr. Ajay Varadachary

LIBRARY SUB-COMMITTEE

Chairman	Dr. Ashok Kothari
Members	Dr. B.F. Chhapgar Mr. Kiran Srivastava Ms. Doreen D'Sa Mr. V.K. Paralkar
Hon. Secretary	Dr. (Ms.) Meena Haribal (up to 26.12.92) Mr. J. C. Daniel (from 28.12.92)
Hon. Treasurer	Mr. C.G. Wakankar (upto 22.12.92) Mr. Sunil Zaveri (from 23.12.92)
Director	Dr. Jay S. Samant
Convenor	Mr. Isaac Kehimkar

PERSONNEL SUB-COMMITTEE

Chairman	Dr. Jay Samant
Members	Mrs. D.S. Variava Dr. Pratap R. Saraiya Dr. A.M. Bhagwat Mr. Yogi Andley
Hon. Secretary	Dr. (Ms.) Meena Haribal (up to 26-12-92) Mr. J.C. Daniel (from 28-12-92)
Hon. Treasurer	Mr. C.G. Wakankar (up to 22.12.92) Mr. Sunil Zaveri (from 23-12-92)
Convenor	Mr. S.V. Ramakrishnan

HONORARY TREASURER'S REPORT FOR THE YEAR ENDED 31ST MARCH 1993

I have the pleasure to report on the 109th Annual Accounts and that the following points may be highlighted hile considering the Accounts and the Auditor's Report for the year 1992-93.

During the year, the Society had surrender 19280 units under various CRTS scheme for repurchase to the nit Trust of India, and have bought right units under the same scheme at par, without investing additional sum f money for exercising the rights offer. The Society had therefore got 23090 units. The old units which were ɔught at a higher value (not at par) were therefore surrender for more units to be purchased at par. The Society as made a notional profit of Rs. 1,63,917/-. However, a sum of Rs. 31,810/- may be deducted from the Divident om Units received, being the loss on surrendering the units being the units sold "Cum-dividend". The profit is ius reflected in the Balance sheet, being more number of units being the assets of the Society, at face value of Rs. 00/- whereas the present value is around Rs. 110/-.

During the year, there are 3 projects which has shown a cumulative over-run of Rs. 12,71,086. There are ill some monies payable to the said projects. It is a matter of grave concern that such over-run had taken places. may be noted that the over-runs are after the 15% administrative charges payable to the Society. However, steps e being taken to avoid them in the future. The funding authorities as on date have already granted sanction for ɔpropriation of the project assets of the Keoladeo Ghana National Park Project. The over-run shall therefore be educed to nearly 3.00 lacs after giving effect of recovery of the same and after providing for depreciation on the ime. The Society is making hectic efforts to take sanction of the other two projects also. It is therefore expected iat as on 31st March 1994, the over-run, after 15% administrative fees and depreciation of the project assets ecovered, shall be reduced by 10.00 lacs.

The Society is facing a serious situation of entering into a situation whereby the funds of the Society ave started showing inadequate funding. This can be highlighted from the following:

.. FIXED, CORPUS, AND CAPITAL FUNDS

		31.3.1993	31.3.1992
1.	Life membership funds	18,30,325	16,89,995
2.	Corporate Life Membership Funds	2,25,742	2,15,742
3.	Vice Patron Funds	42,769	42,769
4.	Corpus Funds (Schedule 'A')	25,31,288	25,26,174
5.	Other Funds (Schedule 'B')	93,33,921	81,07,942
	Total A	1,39,64,045	1,25,82,622

. ASSETS REPRESENTING THE ABOVE CAPITAL

		31.3.1993	31.3.1992
1.	5.5% Government of India loan	2,000	2,000
2.	Various Units of UTI	40,22,078	38,68,842
3.	Fixed Deposit with HDFC	15,00,000	15,00,000

4.	Vehicles	25,962	32,453
5.	Furniture, Fixtures & Equipments	18,89,008	21,33,974
6.	Stock of Books & Publications	3,52,877	3,68,607
7.	Bank Balances	7,14,427	9,09,622
8.	FDR	17,54,158	19,25,000
	Total B	1,02,60,510	1,07,40,497
	This is the shortfall 'A-B'	37,03,535	18,42,125
	This is on account of the following:		
1.	Over-runs on projects (Refer Annex. 1)	12,71,087	1,58,483
2.	Non receipt of Govt. of India Airconditioning Grant	6,44,838	Nil
3.	Non-receipt of Govt. of Maharashtra (1992-93) Grant (Received till date Rs. 2,15,000)	4,45,804	Nil
4.	Non receipt of full amount of grants for the Journal, Collection expenses, Education Scheme and other defeciets & miscellaneous (Refer Annex. 2)	13,41,806	16,83,642
	Total Rs.	37,03,535	18,42,125

The Society is now trying to bridge this gap by formulation of strict internal checks, controls and whole hearted follow-up for the same.

4. During the year a 40 page Budget, of the nature of Cash and Fund flow statement. This is an exercise done for the first time. The said statement have been introduced to have strict day to day monitoring of the finances and to have more fiscal discipline in the Society.

5. Notwithstanding anything above, now is the time to work harder and strive to raise more funds for the Society and be much more actively involved in fund raising task.

I also happy to inform the members that till date the fund raising efforts have raised a sum of Rs. 5,00,000, other than normal income and donations that are regularly being received by the Society. The Society is hopeful to raise a further sum of Rs. 5,00,000 by the end of the year.

For BOMBAY NATURAL HISTORY SOCIETY

Sd/-

Place : Bombay
Date : 2nd November 1993

HONORARY TREASURER

ANNEXURE 1

Expenses Head	Bharatpur	Bird Migration	Elephant
BNHS Administrative Fees	-	1,39,082	91,483
Termination benefits & other Salaries (Net)	20,128	6,69,525	3,72,872
Travel & Perdiem	61,708	1,55,178	1,26,230
Material Supply & Service	16,767	88,509	96,317
Books, Reports, Publications, etc.	15,460	11,999	12,117
Audit fees	-	2,000	2,000
Miscellaneous	-	-	361
Total	1,14,063	10,66,293	7,01,371

ANNEXURE 2

	As on 31.3.1993	As on 31.3. 1992
Journal Grant not received to the full extent	1,25,000	75,000
Govt. of Maharashtra, Collection Maintenance & Nature Education Scheme, grant not received to the full extent	6,34,744	6,34,744
Govt. of Maharashtra for repairs	1,00,000	1,00,000
Air conditioning Grant	-	3,28,917
Miscellaneous	4,82,062	5,44,981
Total	13,41,806	16,83,642

AUDITORS REPORT

Re: BOMBAY NATURAL HISTORY SOCIETY

(Registration No. F-244 Bom)

We have audited the attached Balance Sheet of the Society as at March 31, 1993 and also the annexed Income & Expenditure Account for the financial year ended on that date and report that in our opinion and to the best of our information and according to the explanations given to us:

(a) The accounts are maintained regularly and in accordance with the provisions of the Bombay Public Trust Act, 1950 subject to the observation that as per past practice separate Receipts & Payments Account has been drawn for the Nature Education Scheme and the same has not been incorporated in the accounts of the Society. In this context, we observe that as per the accounts so drawn up, a sum of Rs.1,62,386.62 is considered to be due from the Nature Education Scheme as at the end of the year. We have been given to understand that on settlement of the claim for arrears of the grant from the government, the entire amount would be adjusted.

(b) The receipts and disbursements have been properly and correctly shown in the accounts, subject to the observations that the Society has changed the accounting practice in regard to accounting of the grants from the State Government, which to the extent of Rs.2,30,804/- have been accounted in anticipation of the Sanction, based on the claim preferred. The said grants were hitherto being accounted on receipt of the sanction letters. In our view such income should be accounted when there is no uncertainty about its realisation. We also observe that in respect of the expenses of Rs.6,44,838.38 incurred towards air-conditioning of reference collection rooms and library, the Society is seeking grant from the Central Government, Ministry of Environment and Forests and though by the date of this report, sanction to the extent of 75% of the expenditure incurred by the date of Balance Sheet has been received, subject to certain stipulations to be complied with, the entire expenditure of Rs.6,44,838.38 has been carried forward, as we are informed that efforts are being continued to obtain additional grant to cover the entire expenditure. We are not in a position to offer any comments about its realisability. We also wish to invite attention to para 1(iii) of our last report dated 9.1.93 accompanying the statement of accounts for the year ended 31.3.92, and observe that by the end of the year under report the following three projects were completed and the accounts thereof reflect the over run position as under:

Keoladeo Ghana Sanctuary Project	2,64,927.93
Study of Migration Patterns of Indian Birds	7,80,369.60
Ecology of Indian Elephants	2,25,789.07

We understand that in respect of the last two namedprojects, the compilation of the report and other summing up process of the study carried out are pending and certain further expenditure may be involved in respect of the said projects. In the case of the first named project, the Society as referred to in our last report had received back certain assets, which the Society has since been authorised by the sponsoring authorities to retain. However, pending the evaluation of its useful life and current value, no adjustment has been made in the accounts. We are further informed that the assets forming part of the other two projects are also being retrieved and approval of the sponsoring authorities is proposed to be sought for retaining the assets as may be found useful. We are further informed that on obtaining the necessary approval and evaluation of the useful life of the assets, its estimated value shall also be brought into accounts as per the accounting policy adopted by the Society as outlined in para (e) hereinbelow, and the balance, if any, in the said accounts shall be accordingly adjusted in the current year. We also wish to refer to the observations made in the other paras hereinbelow.

(c) The cash balance and the vouchers in the custody of the accountant on the date of audit were in agreement with the books of accounts.

(d) The books, deeds, accounts, vouchers and/

or other documents or records required by us were produced to us.

(e) The register of movable and immovable properties has been maintained. However, the changes therein have remained to be communicated to the Regional Office. In the context of the equipments and other such capital items acquired out of the various grants and other project funds, we observe that initially the cost of such equipments etc. is charged to the relevant project accounts and on completion of the projects, the Society generally seeks the permission of the concerned sponsoring authorities to retain such assets as are found to be useful for other projects and/or purposes and on obtaining such approvals, the necessary entries are passed in the books of accounts to record the residual value of such items. We observe that pending such approval, the Society is actually utilising a number of such capital assets including vehicles for other projects. It will be appreciated, if the matter is followed up with the concerned authorities to regularise the matter and to bring into account the value of such assets. We have been given to understand that a record of such assets is being separately maintained by the project officers.

(f) The Finance Manager appeared before us and furnished the necessary information required by us.

(g) We are not aware of any property or funds of the Society having been applied for any objects or purpose other than the objects of the Society.

(h) The following items were outstanding for more than one year:

Dues towards Supplies & Services	36,969.80
Loans to staff	8,150.00
Advance for expenses (for projects and other expenses :	
Employees	19,616.45
Others	25,890.75
Other Dues	32,798.00
Souvenir Advertisement	5,350.00
Hornbill Advertisement (since recovered)	24,000.00

Included under the head 'other dues' are certain expenses amounting to Rs.12,433.75, which have been incurred in connection with certain projects and pending certain clarification sought from the concerned sponsoring authority have remained to be adjusted. Included under the said head is a sum of Rs. 6,534/- considered to be due from the Bihar State Government, which is being carried forward for the last few years. We are informed that the matter is being followed up with the said State Government. No amount has been written off during the year. We have been assured that the outstanding balances are considered good and realisable. Incidentally it may be stated that included in other dues are the amount of three remittances aggregating to Rs. 10,252,25 made per Demand Drafts, which are stated to have been lost in transit. We are informed that the matter is being followed up with the concerned bank. Pending the outcome of the enquiries, the said amount is considered good. In the context of the aforesaid outstanding of Rs. 19,616.75 representing advance to employees, we understand that the said employee is no longer in the employment of the Society and the said amount is proposed to be adjusted against the retirement dues payable to him. Included under the head 'Advance for Expenses' (for projects and other expenses) is a sum of Rs.15,890.75 paid to certain organisation for certain project. It will be appreciated, if a proper account of the said advance is obtained from the said organisation and the account is appropriately adjusted.

(i) During the year under report there were no repairs or construction carried out involving an expenditure exceeding Rs. 5,000/- at any time.

(j) We are not aware of any money of the Society having been invested in contravention of Sec. 35 of the Bombay Public Trust Act, 1950.

(k) We are not aware of any immovable property of the Society, therefore, the question of alienation of any property contrary to the provisions of Sec. 36 of the Bombay Public Trust Act, 1950 does not arise.

(l) i) In regard to the expenses charged to various grants and funds we have relied on the information given to us and the authentication of the Hon.Secretary and Hon.Treasurer that the expenses so charged relate to these grants and have

been spent on the specific objects for which the grants were received. While checking the statement of accounts in regard to the expenditure incurred at various camps, we have relied on the authorisation by the Hon.Secretary and Hon.Treasurer, as to the reasonableness of the expenditure.

ii) While on the above subject, we observe that some of the local field workers, whose services were engaged for the said project at Bharatpur, are claiming reinstatement and other service benefits, which is being disputed by the Society. The contingent liability in this regard remains undeterminate. The matter, we are informed, is pending before the Labour Court at Bharatpur and Provident Fund authorities. An ad-hoc provision of Rs.2,64,907/- has been made in the accounts by debiting various projects accounts. The liability has not been determined on actuarial basis.

iii) The income towards membership subscription is being accounted on realisation basis.

iv) The subscriptions received in foreign currency, we observe, are deposited in an account maintained with Grindlays Bank plc., London Branch. The said receipts and disbursements made therefrom have been accounted at the exchange rate prevailing at the date of the Balance Sheet. The closing balance has been translated at the current exchange rate, at the date of the Balance Sheet and the difference in exchange amounting to Rs.4,592.95 has been debited to Income & Expenditure Account. We observe that during the year under report a sum of £.50 equivalent to Rs.2,320/- was credited to the said account. As no proper particulars in respect of the said item were available, the said amount has been credited to Suspense Account. The said Suspense Account as at the date of Balance Sheet shows a balance of Rs. 2,685.75. We suggest that effective steps may be taken to clear the balance in Suspense account.

v) We observe that during the year the Society surrendered the CRTS Units of U.T.I. which it was holding and exercised the option for acquiring the new CRTS which were offered on preferential basis. Since the repurchase price offered was less than the book value, the Society has suffered a book loss of Rs.31,809.54, which has been charged to Income & Expenditure Account.

vi) We suggest the following items of disbursements effected, appropriations made and administrative charges levied be confirmed and ratified at the next meeting of the Executive Committee.

A. DISBURSEMENT FROM

i) Salim Ali Nature Conservation Fund Invest-ment Revenue Account 1,31,742.51

ii) Salim Ali Lok Wan Tho Ornithological Fund Investment Revenue Account 2,237.27

iii) Pirojsha Godrej Foundation Fieldwork Fund Investment Revenue Account 300.00

iv) Col.Burton Nature Conservation Fund Invest-ment Revenue Account 86.12

v) Charles McCann Vertebrate Zoology Fieldwork Fund 8,627.26

vi) Sir Dorabji Tata Trust Fieldwork Fund 2,233.30

vii) Shri M Y Ghorpade of Sandur Photography Exhibition Fund 1,101.60

viii) Education and Research Fund created out of Income 3,217.70

ix) Salim Ali Memorial Fund 9,050.00

x) Staff Gratuity Fund 6,346.00

xi) Proposed Institute Fund 9,212.35

xii) Ministry of Defence, AR &DB, for Bird Hazard Research Cell 1,49,866.95

xiii) Ministry of Defence, ARDB, travel grant for attending Seminar in Israel 46,967.00

xiv) Ministry of Environment & Forests for air-conditioning Library and Hornbill House (Maintenance Grant) 21,453.30

xv) Ministry of Environment and Forests for purchasing scientific equipments during 1988-89 continued in 1989-90 5,218.50

xvi) Ministry of Environment & Forests for purchasing equipments during 1989-90 16,298.00

xvii) Department of Space, Ecological Investiga-tion of Avian Community of Sriharikota 22,552.70

xviii) Ministry of Environment & Forests - Nature Conservation Course — Indian Army. 56,554.45

xix) Grants from United States, Department of Interior, Fish and Wildlife Service for:

a) Hydrobiological (Ecological) Research Project, Keoladeo Ghana Sanctuary, Bharatpur, Rajasthan 7,617.47

b) Ecology of Dry Grassland 10,75,027.13

c) Ecology of Keoladeo Ghana Sanctuary, Bharatpur, Rajasthan 1,14,062.65

d) Ecology of Indian Elephants 7,01,371.10

e) Ecology of Point Calimere Sanctuary 5,464.10

f) Study of the Migration patterns of Indian Birds and Avifauna Migration Study Data Bank 10,66,293.10

g) Study of Conservation of Birds of Prey with particular emphasis upon restoration of Endangered Species 11,13,323.45

h) Habitat and Population Dynamics of Wolves and Blackbucks 4,656.00

xx) Ministry of Environment & Forests for the project "A study of the Habitat requirement of the Rusty Spotted Cat and other Endangered Wildlife of the Dang Forest" by Dr E K Bharucha 3,842.44

xxi) Ministry of Environment & Forests, Indian Environmental Society for Environmental Awareness Campaign 1991-92 30,000.00

xxii) World Wide Fund for Publication of Newsletter 1,985.30

xxiii)Hawk & Owl Trust - Grassland & Roosting Harriers 38,980.75

xxiv)Endangered Turtles of Pondicherry 96,075.60

xxv) Wetland, Mangrove & Coral Reefs in India (UNDP) 11,010.80

xxvi)Smithsonian Institution, Washington, for revision of 'The Handbook of Birds of India and Pakistan' 71,657.50

xxvii) Neyveli Lignite Corporation Limited for Environmental Study at Rajasthan Plant 1,24,008.85

xxviii) National Organic Chemical Industries Ltd. for Environmental Study 2,785.00

xxix) Asian Wetland Bureau for Environmental Awareness Campaign 1991-92 5,113.49

xxx) Grant Govt. of Maharashtra for 1991-92 towards Establishment, Building Maintenance, Educational activity (i.e. Journal printing expenses) 4,45,804.00

B. APPROPRIATIONS

i) Salim Ali Nature Conservation Fund 5,113.49

ii) Salim Ali Nature Conservation Fund Investment Revenue Account 9,714.80

iii) Charles McCann Vertebrate Zoology Fieldwork Fund 600.00

iv) Salim Ali Memorial Fund 21,453.38

v) Publication Fund - BNHS 76,467.95

vi) Publication Fund from Govt. of India, Dept. of Science & Technology 1,06,634.36

vii) Addition to Fixed Assets 5,13,703.50

viii) General Reserve Fund 61,014.20

ix) Staff Gratuity Fund 2,50,000.00

x) Staff Welfare Fund 1,00,000.00

xi) Fixed Assets Fund towards depreciation on Fixed Assets 2,76,348.69

C. Administrative Fees charged to various Grants/ Funds for handling the projects etc. 5,97,321.70

While referring to the observations made in para (b) hereinabove, we suggest that the deferring of the adjustment of the value of the assets retrieved from the Keoladeo Ghana Sanctuary Project pending ascertainment of the useful life of the said assets and its proper evaluation be confirmed in supercession of the resolution passed in the Finance Sub-Committee meeting held on 22.7.1993.

(l) (vii) We observe that the contribution to Employees Provident Fund (both the employees and management contribution) continue to be deposited with the Trustees of a recognised provident fund

established by the Society and governed by the rules framed for the purpose. There seems to have been certain amendments to the Employees Provident Fund and Miscellaneous Provisions Act, 1952, whereunder the Society may be considered to be liable not only to transfer the accumulated balance in the Employee's Provident Fund a/c. to the Provident Fund Commissioner Govt. Scheme, but also for the difference in the amount of contribution. The liability in this regard remains undeterminate. We suggest that proper legal opinion may be sought in this regard and needful may be done in the matter.

(m) So far as is ascertainable from the books of accounts and according to the information and explanation furnished to us by the Finance Manager and the Hon.Secretary, there were no cases of irregular, illegal or improper expenditure or failure to recover the monies or other properties belonging to the Society or loss or waste of money or other property of the Society, subject to the observations made in para (h) hereinabove.

(n) Provisions of Sec. 31-A of the Bombay Public Trust Act, 1950 and Rule 16-A of the Rules framed under the said Act have been complied with.

(o) The maximum and minimum number of Executive Committee members is maintained having regard to the provisions contained in the rules and regulations of the Society.

(p) There is no specific provisions in the rules and regulations of the Society regarding the holding of the meetings of the Executive Committee.

(q) The minute book recording the proceedings of the meetings is maintained.

(r) No member of the Executive Committee has any interest in the investment of the Society.

(s) No member of the Executive Committee is a debtor or creditor of the Society, subject to the observation that a sum of Rs.313/- was due from two members against bills for certain supplies of publication, etc. The said amount has since been received.

(t) There were no irregularities pointed out in our last report dt. 9.1. 93 accompanying the statement of accounts for the year ended 31st March, 1992 except the observations made in para (e), (h) and (l)(ii), the observations whereof have been reiterated hereinabove mutalis mutandis.

CHARTERED ACCOUNTANTS

Bombay
Dated: 27th September, 1993

Regn. No. F-244 (BOM)

BOMBAY NATURAL HISTORY SOCIETY

BOMBAY PUBLIC TRUST ACT, 1950
SCHEDULE VIII VIDE RULE 17 (1)

BALANCE SHEET AS ON 31-3-1993

FUNDS AND LIABILITIES	Rs.	Rs.	PROPERTIES AND ASSETS	Rs.	Rs.
LIFE MEMBERSHIP FUND (Individual)			**IMMOVABLE PROPERTIES**	-	
Balance as per last Balance Sheet	16,89,995.16				
Add: Received during the year	1,40,330.00	18,30,325.16	**INVESTMENTS (AT COST)**		
			5.5% Govt. of India Loan 2000		
CORPORATE LIFE MEMBERSHIP FUND			of the Face Value Rs. 2000		
Balance as per last Blance Sheet	2,15,742.31		(Market Value Rs. 1365/-)		2,000.00
Add: Received during the year	10,000.00	2,25,742.31			
			8530 Units of Unit Trust of India		
VICE PATRON FUND			Under CRTS 1981 Reinvestment Plan		
Balance as per last Balance Sheet		42,769.00	of the Face Value Rs. 100/- Each		
			(Repurchase Value Rs. 9,38,300/-)	8,53,000.00	
CORPUS FUNDS					
As per Schedule 'A'		25,31,287.97	70150 Units of Unit Trust of India		
			Under Unit Scheme 1964		
OTHER FUNDS			of the Face Value Rs. 10/- Each		
As Per Schedule 'B'		93,33,920.68	(Total Face Value Rs. 701500/-)	9,99,637.50	
			(Repurchase Value Rs. 11,22,400/-)		
CURRENT LIABILITIES					
For Unspent Grants			4940 Units of Unit Trust of India		
as per Schedule 'C'	29,60,634.71		Under CRTS 1981		
For Expenses	4,86,167.98		of the Face Value Rs. 100/- Each	4,94,000.00	
For Library Deposits	6,100.00		(Repurchase Value Rs. 5,43,400/-)		
For Sundry Credit Balances	1,54,032.29				
For Advances for Publications and			4770 Units of Unit Trust of India		
Products	29,639.87	36,36,574.85	Under CRTS 1981		
			of the Face Value Rs. 100/- Each	4,77,000.00	
OTHER LIABILITIES		5,721.00	(Repurchase Value 5,24,700/-)		
Amount received for & On Behalf			4850 Units of Unit Trust of India		
of Proposed Institute:-			Under CRTS 1981		
Balance as per last Balance Sheet	2,48,086.11		of the Face Value Rs. 100/- Each	4,85,000.00	
			(Repurchase value Rs. 5,33,500/-)		
Less: Transferred to Schedule 'B'			50000 Units of Unit Trust of India		
Other funds	2,48,086.11	—	Under US 1964 Reinvestment Plan		
			of the Face Value Rs. 10/- Each	7,00,000.00	
INCOME & EXPENDITURE ACCOUNT			(Repurchase Value Rs. 8,00,000/-)		
Balance As Per Last Balance Sheet	46,687.96				
Add: Excess of Income over expenditure			1200 Units of Unit Trust of India		
during the year	37,722.90	84,410.86	Under US 1964 Reinvestment Plan		
			of the Face Value Rs. 10/- Each	13,440.00	40,22,077.50
			(Repurchase Value Rs. 19,200/-)		
Carried over		1,76,90.751.83	Carried over		40,24,077.50

FUNDS AND LIABILITIES	Rs.	Rs.	PROPERTIES AND ASSETS	Rs.	Rs.
Brought over		1,76,90,751.83	Brought over		40,24,077.50
			Fixed Deposit With Housing Development Corporation Ltd.		15,00,000.00
			VEHICLES		
			Balance As per Last Blance Sheet	32,453.43	
			Less: Depreciation during the year	6,490.69	25,962.74
			FURNITURE, FIXTURES & EQUIPMENTS		
			Balanace As Per Last Blance Sheet	21,33,974.29	
			Add: Additions during the year	24,891.50	
				21,58,865.79	
			Less: Depreciation during the year	2,69,858.00	18,89,007.79
			LOANS		
			(Unsecured Considered Good)		
			To Employees		69,320.00
			ADVANCE		
			For Project & Other Expenses	4,28,646.60	
			To Others		
			For Project & Other Expenses	2,23,250.66	
			Advances against salaries		
			To Employees	4,010.00	
			Dues From Nature Education Scheme	1,62,386.62	
			Due from Unit Trust of India	867.57	
			Other dues for Travel and other expenses	1,91,357.90	10,10,519.35
			DEPOSITS		
			BEST Undertaking	68,130.00	
			Mahanagar Telephone Nigam Ltd.	11,000.00	
			P & T Dept. for Project Telephones	11,000.00	
			NCST for Electronic Mailing	1,000.00	
			Gas Cylinder for Projects	8,950.00	
			Elec. Deposit for Projects	561.00	
			For Vehicle Fuel Supply	2,500.00	
			For Franking Machine	420.15	
			For Accommodation	1,78,396.00	2,81,957.15
Carried over ...		1,76,90,751.83	Carried over ...		88,00,844.53

FUNDS AND LIABILITIES	Rs.	Rs.	PROPERTIES AND ASSETS	Rs.	Rs.
Brought over		1,76,90,751.83	Brought over		88,00,844.53
			STOCKS		
			As Per Inventories Taken And Certified By the Hon. Secretary		
			BNHS Publications	3,10,987.32	
			Govt. Publications	41,890.80	
			Greeting Cards	86,389.08	
			BNHS T Shirts	715.00	
			BNHS Mugs	2,796.50	
			BNHS Caps	-	
			Rare Painting Photographs	3,100.00	4,45,878.70
			Books Under Publication (Expenses Incurred Till Date)		
			Book of Indian Birds (New Edition)	1,55,305.00	
			Some Beautiful Indian Trees	22,891.36	1,78,196.36
			INCOME OUTSTANDING		
			Interested Accrued	2,02,568.40	
			For Publications	2,45,833.73	
			For Greeting Cards	70,081.20	
			For Calendars	23,119.50	
			For Souvenir Advertisements	5,350.00	
			For Hornbill Advertisements	36,000.00	
			For Xerox Charges	40,157.75	
				6,23,110.60	
			Grants Receivable		
			From NOCIL	29,000.00	
			From AR&DB	2,31,710.00	
			From Neyveli Lignite Corpn. Ltd.	1,80,000.00	
			From Govt. of India (Reference Collection airconditioning Exp.)	6,44,838.38	
			From Govt. of Maharashtra (1992-93)	4,45,804.00	
			From Govt. of India (Environment and Forests), Nature Conservation course for Indian Army	1,00,000.00	22,54,462.98
Carried over ...		1,76,90,751.83	Carried over ...		1,16,79,382.57

FUNDS AND LIABILITIES	Rs.	Rs.	PROPERTIES AND ASSETS	Rs.	Rs.
Brought over		1,76,90,751.83	Brought over		1,16,79,382.57
			CASH AND BANK BALANCES		
			As Per Schedule D		47,40,282.66
			UNADJUSTED DEFICIT ON PROJECTS		
			(a) Keoladeo Ghana Sanctuary Project as per last Balance Sheet	1,58,482.75	
			Less: transfer of grant balances from Hydrobiological Research project	7,617.47	
				1,50,865.28	
			Add: Expenditure during the year	1,14,062.65	2,64,927.93
			(b) Study of Migration patterns of Indian Birds as per last balance Sheet (Credit Balance)	2,85,923.50	
			Less: Expenditure during the year	10,66,293.10	7,80,369.60
			(c) Ecology of Indian Elephants as per the last Balance Sheet (Credit Balance)	4,75,582.03	
			Less: Expenditure during the year	7,01,371.10	2,25,789.07
	Grand Total ...	1,76,90,751.83	Grand Total ...		1,76,90,751.83

BOMBAY NATURAL HISTORY SOCIETY

Sd/-

J.C. DANIEL
HONORARY SECRETARY

Sd/-

SUNIL R. ZAVERI
HONORARY TREASURER

AS PER OUR REPORT OF EVEN DATE

Sd/-

HABIB AND COMPANY
CHARTERED ACCOUNTANTS
BOMBAY

Bombay
Dated 27th September 1993

BOMBAY NATURAL HISTORY SOCIETY

SCHEDULE FORMING PART OF THE BALANCE SHEET AS ON 31-3-1993

SCHEDULE A : CORPUS FUNDS

Name of the Corpus Bund	Balance as per last Balance Sheet	Amounts received/ Appropriated during the year	Total of Columns 1and 2	Balance as on 31-3-1993
	1	2	3	4
	Rs.	Rs.	Rs.	Rs.
Salim Ali Nature Conservation Fund	20,71,554.96	5,113.49	20,76,668.45	20,76,668.45
Salim Ali/Loke Wan Tho Ornithological Research Fund	4,03,136.52	-	4,03,136.52	4,03,136.52
Pirojsha Godrej Foundation Fieldwork Fund	40,000.00	-	40,000.00	40,000.00
Col. Burton's Nature Conservation Fund	11,483.00	-	11,483.00	11,483.00
Total Rs.	25,26,174.48	5,113.49	25,31,287.97	25,31,287.97

BOMBAY NATURAL HISTORY SOCIETY
SCHEDULE FORMING PART OF THE BALANCE SHEET AS ON 31-3-1993
SCHEDULE B: OTHER FUNDS

Name of the Other Fund	Balance As Per Last Balance Sheet	Amount Recd/ Appropriated during the year	Interest Credited during the year	Total of Columns 1,2 & 3	Transferred to Income & Expenditure Account during the year	Expenditure on objects of Trust/ Other Exps. as shown in Income & Exp. Account	Balance as on 31-3-1993
	1	2	3	4	5	6	7
Salim Ali Nature Conservation Fund Investment Revenue Account	1,38,559.06	10,274.80	2,07,155.50	3,55,989.36	1,31,742.51	1,31,742.51	2,24,246.85
Salim Ali - Loke Wan Tho Ornithological Fund Investment Revenue Account	71,926.87	-	40,313.65	1,12,240.52	2,237.27	2,237.27	1,10,003.25
Pirojsha Godrej Foundation Fieldwork Fund Investment Revenue Account	7,950.49	-	4,000.00	11,950.49	300.00	300.00	11,650.49
Col. Burton's Nature Conservation Fund Investment Revenue Account	3,362.81	-	1,148.30	4,511.11	86.12	86.12	4,424.99
Charles MaCann Vertebrate Zoology Fieldwork Fund	1,05,707.93	600.00	10,570.79	1,16,878.72	8,627.26	8,627.26	1,08,251.46
Sir Dorabji Tata Trust Fieldwork Fund	2, 233.30	-	-	2,233.30	2,233.30	2,233.30	-
Shri M.Y. Ghorpade of Sandur Photography Exhibition Fund	1,101.60	-	-	1,101.60	1,101.60	1,101.60	-
Plant Study Fund	43,774.80	-	-	43,774.80	-	-	43,774.80
Education & Research Fund Created Out of Income	63,392.46	-	-	63,392.46	3,217.70	3,217.70	60,174.76
Chacko Fund For Education And Conservation	37,559.70	-	-	37,559.70	-	-	37,559.70
Salim Ali Memorial Fund	22,73,429.41	23,189.38	-	22,96,618.79	9,050.00	9,050.00	22,87,568.79
Publication Fund - BNHS	12,71,224.32	1,76,467.95	-	14,47,692.27	-	-	14,47,692.27
Publication Fund From Govt. of India Dept. of Science & Technology	5,16,994.66	6,694.36	-	5,23,689.02	-	-	5,23,689.02
Carried over Rs.	45,37,217.41	2,17,226.49	2,63,188.24	50,17,632.14	1,58,595.76	1,58,595.76	48,59,036.38

Schedule 'B' contd.

Name of the Other Fund	Balance As Per Last Balance Sheet	Amount Recd/ Appropriated during the year	Interest Credited during the year	Total of Columns 1,2 & 3	Transferred to Income & Expenditure Account during	Expenditure on objects of Trust/ Other Exps. as shown in Income & Exp. Account	Balance as on 31-3-1993
	1	2	3	4	5	6	7
Brought over Rs.	45,37,217.41	2,17,226.49	2,63,188.24	2,63,188.24	50,17,632.14	1,58,595.76	48,59,036.38
Fixed Assets Fund	13,85,320.68	5,13,703.50	-	18,99,024.18	2,76,348.69	2,76,348.69	16,22,675.49
Building Fund	5,03,227.68	-	-	5,03,227.68	-	-	5,03,227.68
General Reserve Fund	6,72,624.02	61,014.20	-	7,33,638.22	-	-	7,33,638.22
Staff Gratuity Fund	8,36,309.81	2,50,00.00	-	10,86,309.81	6,346.00	6,346.00	10,79,963.81
Staff Welfare Fund	98,242.34	1,03,263.00	-	2,01,505.34	-	-	2,01,505.34
Donation From Seth Purshotamdas Thakurdas & Divaliba Charitable Trust For Publication of Tree Book	75,000.00	-	-	75,000.00	-	-	75,000.00
Proposed Institute Fund (amount received in earlier year transferred from other head)	-	2,48,086.11	20,000.00	2,68,086.11	9,212.35	9,212.35	2,58,873.76
	81,07,941.94	13,93,293.30	2,83,188.24	97,84,423.48	4,50,502.80	4,50,502.80	93,33,920.68

Summary of Expenditure From Funds/Donations

Expenditure Head		Amount Rs.
Expenses on objects:		
Nature Conservation		1,31,742.51
Natural History Study		12,231.08
Hornbill printing (part)		1,101.60
Nature Education Camp (part)		2,233.30
Other Educational expenses		2,237.27
		1,49,545.76
Others		
Miscellaneous:		
Beautification of Dr. Salim Ali Chowk	9,050.00	
Goregaon plot expenses	9,212.35	18,262.35
Gratuity to staff		6,346.00
Depreciation		2,76,348.69
Total Rs.		4,50,502.80

Details of Amounts Transferred to Fixed Assets Fund

	Amount Rs.
1. Grant Govt. of India D.O.E. For Airconditioning Library and Collection Rooms against expenditure in earlier year.	4,92,187.00
2. Appropriation of funds - Ministry of Environment for Scientific equipment (1989-90)	5,218.50
3. -do-	16,298.00
Total Rs.	5,13,703.50

BOMBAY NATURAL HISTORY SOCIETY
SCHEDULE FORMING PART OF THE BALANCE SHEET AS ON 31-3-1993
SCHEDULE C: GRANTS

Name of the Grant	Balance As Per Last Balance Sheet	Amount Recd./ Receivable during the year	Total of Columns 1 & 2	Transferred To Income & Expenditure Account during the year	Expenditure On Objects of Trust/ Other Exps As Shown In Income & Exp. Account	Balance As On 31-3-1993
	1	2	3	4	5	6
GRANTS FROM GOVT. OF INDIA	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Ministry of Defence, ARDB, For Bird Hazard Research Cell	1,60,911.21	2,00,000.05	3,60,911.26	1,49,866.95	1,49,866.95	2,11,044.31
Ministry of defence, ARDB, Travel Grant for attending seminar in Israel	46,967.00	-	46,967.00	46,967.00	46,967.00	-
Ministry of Environment & Forests for secretarial assistance to Dr. Salim Ali for Environmental Research Program & Processing Archieval Material	21,453.38	-	21,453.38	21,453.38	21,453.38	-
Ministry of Environment & Forests For Airconditioning Library & Collection Rooms At Hornbill House	-	4,92,187.00	4,92,187.00	4,92,187.00	4,92,187.00	-
Ministry of Environment & Forests For Purchasing Scientific Equipments during 1988-89 continued In 1989-90	12,574.10	-	12,574.10	5,218.50	5,218.50	7,355.60
Ministry of Environment & Forests For Purchasing Equipments during 1989-90	16,298.00	-	16,298.00	16,298.00	16,298.00	-
Dept. of Science & Technology For Publication of Tree Book	51,873.10	-	51,873.10	-	-	51,873.10
Ministry of Environment & Forests For the Project 'A Study of the Habitat Requirement of the Rusty Spotted Cat and other Endangered Wildlife of the Dang Forest By Dr. E.K. Bharucha	3,842.44	-	3,842.44	3,842.44	3,842.44	-
Carried over Rs.	3,13,919.23	6,92,187.05	10,06,106.28	7,35,833.27	7,35,833.27	2,70,273.01

Schedule 'C' contd..

Name of the Grant	Balance As Per Last Balance Sheet	Amount Recd./ Receivable during the year	Total of Columns 1 & 2	Transferred To Income & Expenditure Account during the year	Expenditure On Objects of Trust/ Other Exps As Shown In Income & Exp. Account	Balance As On 31-3-1993
	1	2	3	4	5	6
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Brought over Rs.	3,13,919.23	6,92,187.05	10,06,106.28	7,35,833.27	7,35,833.27	2,70,273.01
Deptt. of Space, Ecological Investigation of Avian Community of Sriharikota	-	1,12,640.00	1,12,640.00	22,552.70	22,552.70	90,087.30
Dept. of Science & Technology NCSTC for Publications of Hornbill Series	-	2,40,000.00	2,40,000.00	-	-	2,40,000.00
Ministry of Environment & Forests Nature Conservation Course - Indian Army	-	1,25,000.00	1,25,000.00	56,554.45	56,554.45	68,445.55
GRANTS FROM UNITED STATES DEPT. OF INTERIOR, FISH & WILDLIFE SERVICE FOR RESEARCH PROJECTS						
Hydrobiological (Ecological) Research Project - Keoladeo Ghana Sanctuary Bharatpur, Rajasthan	7,617.47	-	7,617.47	7,617.47	7,617.47	-
Ecology of Dry Grasslands	10,07,225.70	8,52,017.00	18,59,242.70	10,75,027.13	10,75,027.13	7,84,215.57
Ecology of Keoladeo Ghana Sanctuary Bharatpur, Rajasthan	-1,58,482.75	7,617.47	-1,50,865.28	1,14,062.65	1,14,062.65	-2,64,927.93
Ecology of Indian Elephant	4,75,582.03	-	4,75,582.03	7,01,371.10	7,01,371.10	-2,25,789.07
Ecology of Pt. Calimere Sanctuary	83,504.52	-	83,504.52	5,464.10	5,464.10	78,040.42
Study of the Migration Patterns of Indian Birds and Avifauna Migration Study Data Bank	2,85,923.50	-	2,85,923.50	10,66,293.10	10,66,293.10	-7,80,369.60
Study of Conservation of Birds of Prey with particular emphasis upon Restoration of Endangered Species	17,38,728.25	-	17,38,728.25	11,13,323.45	11,13,323.45	6,25,404.80
Habitat and Population Dynamics of Wolves & Blackbucks	4,656.00	-	4,656.00	4,656.00	4,656.00	-
Carried over Rs.	37,58,673.95	20,29,461.52	67,88,135.47	49,02,755.42	49,02,755.42	8,85,380.05

Schedule 'C' Contd..

Name of the Grant	Balance As Per Last Balance Sheet	Amount Recd./ Receivable during the year	Total of Columns 1 & 2	Transferred To Income & Expenditure Account during the year	Expenditure On Objects of Trust/ Other Exps As Shown In Income & Exp. Account	Balance As On 31-3-1993
	1	2	3	4	5	6
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Brought over Rs.	37,58,673.95	20,29,461.52	67,88,135.47	49,02,755.42	49,02,755.42	8,85,380.05
OTHER GRANTS						
Chief Wildlife Warden Jammu & Kashmir For survey of Blacknecked Crane	26,111.94	-	26,111.94	-	-	26,111.94
Smithsonian Institution, Washington For Revision of `the Handbook of Birds of India & Pakistan'	1,01,137.97	-	1,01,137.97	71,657.50	71,657.50	29,480.47
World Wide Fund For Publication of Newsletter	1,985.30	-	1,985.30	1,985.30	1,985.30	-
Neyveli Lignite Corporation Ltd. For Environment Study At Rajasthan Plant	3,21,133.70	1,80,939.50	5,02,073.20	1,24,008.85	1,24,008.85	3,78,064.35
Gujarat Ambuja Cement Co. Ltd. For Environment Study At Rajasthan Plant	11,138.00	-	11,138.00	-	-	11,138.00
National Organic Chemical Industries Ltd. For Environmental Study	76,871.45	29,000.00	1,05,871.45	2,785.00	2,785.00	1,03,086.45
Asian Wetland Bureau For Environmental Awareness Campaign 1991-92	5,113.49	-	5,113.49	5,113.49	5,113.49	-
Hawk & Owl Trust - Grassland Roosting Harriers	-	79,854.00	79,854.00	38,980.75	38,980.75	40,873.25
Endangered Turtles of Pondicherry	-	1,95,000.00	1,95,000.00	96,075.60	96,075.60	99,424.40
Wetland, mangroves and Coral Reefs in India (UNDP)	-	1,27,000.00	1,27,000.00	11,010.80	11,010.80	1,15,989.20
Total Rs.	43,02,165.80	26,41,755.02	69,43,920.82	52,54,372.41	52,54,372.41	16,89,548.11

Schedule 'C' Contd..

Summary of Expenditure Out of Grants

Particulars	Amount Rs.			
Expenditure on various Projects including Capital Expenditure	47,09,446.34	Total Unspent Balances		29,60,634.71
		Less: Overspent On -		
Capital Expenditure from Grants -		Keoladeo Ghana Sanctuary Project	2,64,927.93	
Amount transferred to Fixed Assets Fund (Refer To Schedule 'B')	5,13,703.50	Ecology of Indian Elephant	2,25,789.07	
Amount trasnferred to General Reserve Fund	4,656.00			
Amount Transferred to Salim Ali Memorial Fund	21,453.38	Study of Migration Pattern of Indian Birds	7,80,369.60	12,71,086.60
Amount transferred to Salim Ali Nature Conservation Fund	5,113.49			
Total Rs.	52,54,372.71			16,89,548.11

BOMBAY NATURAL HISTORY SOCIETY
SCHEDULE FORMING PART OF THE BALANCE SHEET AS ON 31-3-1993
SCHEDULE D: CASH AND BANK BALANCES

	Rs.	Rs.
A. In Current Account With		
ANZ Grindlays Bank p.l.c. M.G. Road Branch	10,274.38	
ANZ Grindlays Bank p.l.c. James Square, London Branch (Sterling Pounds 2229.59 @ Rs. 48.46 Each)	1,02,934.96	1,13,209.34
B. In Savings Account With		
ANZ Grindlays Bank p.l.c. M.G. Road Branch	29,523.77	
Bank of India Museum Savings Branch	5,48,899.24	
State Bank of India Gateway of India Branch	17,71,696.43	
Canara Bank Sir P.M. Road Branch	5,172.50	
Corporation Bank Dalal Street Fort Branch	16,434.56	
Corporation Bank Dalal Street Fort Branch (FCRA Account)	1,188.82	23,72,915.32
C. In Fixed Deposit With		
ANZ Grindlays Bank p.l.c., M.G. Road Branch	6,00,000.00	
Bank of India, Bombay Main Branch	6,50,000.00	
Corporation Bank, Dalal Street Fort Branch	5,04,158.00	
State Bank of India, Gateway of India Branch	5,00,000.00	22,54,158.00
	Total Rs.	47,40,282.66

Regn. No. F-244 (BOM)

BOMBAY NATURAL HISTORY SOCIETY
INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31-3-1993

EXPENDITURE	Rs.	Rs.	INCOME	Rs.	Rs.
EXPENDITURE IN RESPECT OF PROPERTIES			**INTEREST (RECEIVED & ACCRUED)**		
			On Govt. Securities	110.00	
Municipal Taxes	4,926.00		On Fixed Deposits	5,71,619.60	
Building Insurance	278.00		On Saving Accounts	38,737.54	6,10,467.14
Building Maintenance	15,535.00	20,739.00			
			DIVIDENDS		
ESTABLISHMENT EXPENSES			On Units of UTI Schemes		8,22,088.50
Salaries of Reference Collection & Maintenance staff	4,35,257.00		**DONATIONS**		
Salaries of other Staff	10,73,508.00		For Specific Purposes:-		
Leave Travel Allowances	19,920.00		SANCF Corpus Fund	560.00	
Medical Allowances	19,797.30		Salim Ali Memorial Fund	1,736.00	
Compensation to staff	31,281.00		Charles MaCann Vertebrate Zoology Fund	600.00	
Uniform and umbrellas to staff	7,737.40		Hornbill printing	20,000.00	
Washing Allowances	3,600.00			22,896.00	
Management's contribution to Provident Fund	65,434.00		For various projects	4,04,585.18	4,27,481.18
Gratuity paid to staff	6,346.00				
Casual Labour	11,146.00		**GRANTS**		
Meeting Expenses	52,283.35		From Govt. of Maharashtra for Establishment Expenses for 1992-93		
Postage Expenses	16,339.70		Collections	3,74,151.00	
Printing & Stationery	48,415.75		Nature Education	59,653.00	
Advertisements	12,308.00		Building maintenance	8,000.00	
Telephone Expenses	57,605.90		Journal printing	4,000.00	
Electricity Expenses	41,433.20			4,45,804.00	
Electrical Repairs	13,194.00				
Travelling Expenses	56,319.76				
Conveyance Expenses	25,222.10				
Vehicle Maintenance	61,541.50				
Bank Charges (Net)	6,477.50				
Audit Fees	2,000.00		Other grants As per Schedule 'C' (To the extend utilised during the year)	52,54,372.71	57,00,176.71
Repairs to Furniture & Equipment	42,972.30				
Insurance other than building	4,219.00				
Professional & Legal Fees	40,200.00		**SUBSCRIPTIONS**		
Loss on surrender of Units of UTI	31,869.54		Ordinary Members		
Exchange fluctuation	4,592.95		Individuals	1,61,610.99	
Computer maintenance	45,000.00	22,36,021.25	Family	7,300.00	
			Student	11,940.00	
MISCELLANEOUS EXPENSES			Corporate	11,300.00	
Garden Maintenance Exps.	8,748.00		LIfe Memberships (Individual)	1,40,330.00	
Beautification of Dr. Salim Ali Chowk	9,050.00		Life Memberships (Corporate)	10,000.00	
General Expenses	24,195.00		Journal - Members	40,207.00	
Goregaon Plot Expenses	9,212.35	51,205.35	Journal - Non-Members	60,990.55	
Salaries, etc.			Entrance Fees	28,409.00	4,71,997.54
Carried over Rs.		23,07,965.60	Carried over Rs.		80,32,211.07

EXPENDITURE	Rs.	Rs.	INCOME	Rs.	Rs.
Brought over Rs.		23,07,965.60	Brought over Rs.		80,32,211.07
DEPRECIATION			**INCOME**		
On Vehicles, Furniture			From BNHS Publications (net)	2,32,218.44	
and Equipments		2,76,348.69	From Govt. Publications	6,694.36	
			From Greeting Cards	66,453.79	
			Calendars	14,982.09	
AMOUNTS TRANSFERRED TO FUNDS			BNHS Caps	662.90	
AGAINST INCOME			Old Paintings Photographs	200.00	
Specific Purpose Donations			BNHS Mugs	591.30	
as per Contra	22,896.00				
Life Membership Fees Fund	1,40,330.00			3,21,802.88	
Corporate Life Membership	10,000.00		Less: Deficit on		
BNHS Publication Fund			BNHS T-Shirts	171.46	3,21,631.42
50% Royalty on Dr. Salim					
Ali's Publications	76,467.95		**OTHER RECEIPTS**		
Govt. Publication Fund	6,694.36		Miscellaneous Receipts	13,186.01	
Staff Welfare Fund			Surplus on Members' Camps	68,780.30	
Interest on loan to staff	3,263.00		Royalty on Dr. Salim Ali's		
Fixed Asset Funds	5,13,703.50		Publications	1,52,935.91	
Interest allocation to Funds	2,83,188.24		Xerox service charges	6,433.50	
General Reserve Fund	11,014.20		Interest on Loan to staff	3,263.00	
Salim Ali Memorial Fund	21,453.38		Sundry credit balance written off	16,073.00	2,60,671.72
Salim Ali Nature Conservation Fund	5,113.49				
Salim Ali Investment Revenue a/c.	9,714.80	11,03,838.92			
			ADMINISTRATIVE FEES		
APPROPRIATIONS TO FUNDS			For Project Funds	5,66,660.73	
OUT OF SURPLUS			For Govt. Publication Funds	1,505.64	
Staff Welfare Fund	1,00,000.00		For Other Funds	29,155.33	5,97,321.70
Staff Gratuity Fund	2,50,000.00				
General Reserve Fund	50,000.00				
Publication Fund	1,00,000.00	5,00,000.00	**AMOUNTS DRAWN FROM FUNDS**		
			For Natural History Study	12,231.08	
EXPENDITURE ON THE			For Nature Conservation	1,31,742.51	
OBJECTS OF THE TRUST			For Other Educational Exps	2,237.27	
Expenses met out of funds			For Gratuity Payment	6,346.00	
as per Schedule 'B'	1,49,545.76		For Depreciation	2,76,348.69	
Expenses met out of grants			For Beautification of		
as per Schedule 'C'	47,09,446.34		Dr. Salim Ali Chowk	9,050.00	
Journal Printing & Postage	2,85,950.35		For Hornbill Printing		
Hornbill Printing & Postage	1,94,217.30		(M.Y. Ghorpade Fund)	1,101.60	
Nature Education	25,171.75		For Nature Education Camp		
Members activities	38,037.70		(Dorabji Tata Trust Fund)	2,233.30	
			For Goregaon Plot expenses -		
	54,02,369.20		(Proposed Institute Fund)	9,212.35	4,50,502.80
Carried over Rs.		41,88,153.21	Carried over Rs.		95,62,338.71

EXPENDITURE	Rs.	Rs.	INCOME	Rs.	Rs.
Brought over Rs.	54,02,369.20	41,88,153.21	Brought over Rs.		96,62,338.71
Library Books, Books binding, Subscriptions & Contingencies	33,465.40				
Post Graduate Studies	628.00	54,36,462.60			
		96,24,615.81			
BALANCE OF SURPLUS CARRIED FORWARD		37,722.90			
		96,62,338.71			96,62,338.71

BOMBAY NATURAL HISTORY SOCIETY

Sd/- Sd/-

J. C. DANIEL
HONORARY SECRETARY

SUNIL R. ZAVERI
HONORARY TREASURER

AS PER OUR REPORT OF EVEN DATE

Sd/-

HABIB AND COMPANY
CHARTERED ACCOUNTANTS
BOMBAY

Bombay
Dated 27th September, 1993.

BOMBAY NATURAL HISTORY SOCIETY
NATURE EDUCATION SCHEME

RECEIPT AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31-3-1993

RECEIPTS	Rs.	PAYMENTS	Rs.
To Balance as on1-4-1992 In Current Account with ANZ Grindlays Bank p.l.c.	1,200.99	By Amounts Due to BNHS As on 1-4-1992	1,02,966.87
		By Salaries To Nature Education Organiser	56,653.00
To Grant - Govt. of Maharashtra For the year 1992-93	-	By Contingency Expenses	3,000.00
To Sale of Nature Education Booklets	233.25	By Balance As On 31-3-1993 In Current Account With ANZ Grindlays Bank p.l.c.	1,200.99
To Amounts Due to BNHS As on 31-3-1993	1,62,386.62		
	1,63,820.86		1,63,820.86

BOMBAY NATURAL HISTORY SOCIETY

Sd/-
J. C. DANIEL
HONORARY SECRETARY

Sd/-
SUNIL R. ZAVERI
HONORARY TREASURER

AS PER OUR REPORT OF EVEN DATE

Sd/-
HABIB AND COMPANY
CHARTERED ACCOUNTANTS
BOMBAY

Bombay
Dated 27th September, 1993

BOMBAY NATURAL HISTORY SOCIETY

Minutes of the Annual General Meeting held on 28th January 1993

The Annual General Meeting (AGM) of the Society for the year 1991-92 was held at Hornbill House on 28.1.1993 at 6.30 p.m. The following were present:

Mr S.R. Burman, Mr. H.C. Mistry, Mr. K.K. Doctor, Mr. Virinder Singh, Mr. Suhel Quader, Mr. K.P. Karamchandani, Mr. N.D. Mulla, Mr. Mihir Devare, Mr. Ulhas Paralkar, Mr. N.P. Behramfram, Mr. Nitin Jamdar, Mr. Rishad Naoroji, Mr. Vilas Shingre, Mr. Ashutosh Gogate, Dr. Shashi Menon, Ms. Jayshree Sethna, Mr. Bharat Bhushan, Mr. S. Krishnan, Mr. N. Chaturvedi, Mr. Kiran Srivastava, Mr. Ulhas Rane, Ms. Katie Rustomjee, Mr. Unmesh Brahme, Mr. Sam Bhacka, Mr. S.L. Chullani, Mr. M.I. Fernandes, Mr. J.C. Daniel, Dr. A.M. Bhagwat, Mr. Shashank S. Ranjit, Dr. Pratap R. Saraiya, Prof. P.V. Bole, Mr. D.C. Balsara, Mr. Sunil R. Zaveri, Mr. Sunjoy Monga, Mr. Humayun Abdulali, Dr. Jay S. Samant, Mrs. D.S. Variava, Mr. H.C. Khatiwala, Mr. Yazdi Bulsara, Dr. Renee Borges, Mr. Kishore Somaiya, Mr. Anil Kunte, Ms Celine Anthony, Mr Rusi Kharas, Mr. Ajay Varadachary, Mr. Goutam Narayan, Mr. J.G. Mahajan, Mr. Eustace Vessaokar, Mr. Sudhakar Solomon Raj, Mr. S.R. Sane, Mr. H. Panjabi, Ms Doreen D'Sa, Mr. Leo Soares, Ms. M.D. Bharucha, Mr. K.R. Shah, Mr. K.K. Vajifdar, Mr. S. K. Vajifdar. Mr. M.K. Fatehi, Mr. Bittu Sahgal, M/s Sanctuary Magazine, Mr. C.G. Wakankar, Mr. M.R. Almeida, Dr. Robert Grubh, Dr. B.F. Chhapgar, Mr. Mangesh Chavan.

The President, Prof. P.V. Bole, welcomed the members to the AGM. Before the proceedings commenced the members stood in silence for 2 minutes as a mark of respect to the memory of Mr. Justice M. Hidayatullah, former President of the Society and Dr. P.J. Deoras, former member of the Executive Committee of the Society who died during the year.

The President announced that the Executive Committee had elected Mr. Humayun Abdulali, former Vice-President of the Society as 'Emeritus Scientist' of the Society. He also stated that two senior employees of the Society, namely Mr. V.C. Ambedkar, Scientist, and Dr. Robert B. Grubh, Dy. Director (Research), had retired; the former on superannuation and the latter on voluntary retirement. As a token of the appreciation and regard of the Society the President presented Mr. Humayun Abdulali, Mr. V.C. Ambedkar, Dr. Robert B. Grubh with bouquets.

The Hon. Secretary advised that Prof. Bole had expressed his desire not to seek re-election as President in view of his deteriorating health and the Executive Committee had acceded to this with great regret. In appreciation of Prof. Bole's commitment to the welfare of the Society and as a token of the love and regard of its members a bouquet was presented to Prof. Bole.

Prof. Bole stated that Mr. B.G. Deshmukh, retired Cabinet Secretary to the Government of India, had kindly consented to be President of the Society from 1.2.1993.

The President then reported on:

i) the nominations of Mrs. D.S. Variava, Dr. Pratap R. Saraiya and Mr. D.S. Chavda as Vice Presidents of the Society for 1993 and 1994.

ii) elections of Mr. J.C. Daniel as Honorary Secretary (in place of Dr. (Ms) Meena Haribal who has gone to Cornell University for further studies) and Mr. Sunil R. Zaveri as Honorary Treasurer (in place of Mr. C.G. Wakankar) for the remaining period of the Committee;

iii) confirmation of Dr. Jay S. Samant as Director of the Society from 10 December 1992.

Item I) Confirmation of Minutes:

The minutes of: (a) Annual General Meeting held on 14th September 1991 and b) Adjourned Annual General Meeting held on 11.11.1991 were confirmed. Proposed by Dr. B.F. Chhapgar and seconded by Mr. Ulhas Rane.

Item II) Annual Report of the Committee for the year 1991-92.

Mr. Ulhas Rane suggested that (i) on the cover page, the names of those office bearers elected at the time of formation of the new Committee only need be mentioned, (ii) the report should cover the period January-December and not the financial year, and (iii) items not covered during the period of the report may be excluded.

Mr. S. Krishnan enquired whether a report on the survey of plants in Borivli National Park (mentioned at page 5 of the Report under Natural History Studies Sub-committee) had been received. Mr. Nitin Jamdar suggested that instead of "one of the scientists presented a paper (reported under Reptiles and Amphibians section on page 2 of the Report), the name or names of the Scientists may be given.

Mr. N.K. Behramfram desired to know the level of membership at the end of December 1992.

Mrs. Variava advised that the suggestions made by the members had been noted and requested that the Report as presented by the Committee be approved.

The report was thereafter approved, duly proposed by Mr. Ulhas Rane and seconded by Dr. A.M. Bhagwat.

Item III) Balance Sheet and Statement of Accounts for 1991-92:

Mr. C.G. Wakankar while presenting a note on the Balance Sheet, etc. cautioned that in the absence of new Projects being funded administrative fees would not be available as a source of income and all members should endeavour to raise resources for the Society.

Mr. N.D. Mulla drew attention to the over run in the "Ecology of Keoladeo Ghana" Sanctuary Project to the extent of Rs. 1,58,482.75, which may drastically affect the income from administrative charges. He desired that the responsibilities for the over run should be fixed and adequate steps be taken to avoid recurrence of this type. Responding the Hon. Secretary clarified the appropriate steps had been initiated to avoid over runs.

Mr. N.K. Behramfram inquired about the position of the other Projects. Mr. Anil Kunte desired to know as to how the Absorption Spectro Photometer brought from Bharatpur to Bombay was being put to use. Mr Humayun Abdulali suggested having a large number of smaller projects. This was supported by Mr Hirabhai Khatiwalla.

Mr. Nitin Jamdar noted that there was an income surplus on members' camps and suggested there should appropriately be spent on members' activities. This aspect may be looked into by the Programmes Sub-Committee. Ms Katie Rustomjee complained that the charges for camps were high.

Reacting to this, Mr. C.G. Wakankar mentioned the case of the RSPB which spent only a small portion of the subscription on members' activities. It raised its funds through other sources. Similarly for BNHS also the members should join together to bring in more funds.

Mr Kunte suggested the need to have local Chapters. In Thane alone, there were about 200 members Mr. Nitin Jamdar suggested organising programmes at District levels. Mr. Wakankar clarified that the Executive Committee of BNHS had supported the Programmes undertaken at Thane and similar activities should be started in other centres also. In this context, Mr Hirabahai Khatiwalla enquired about the response received for the Appeal for donation issued by the Hon. Secretary. (It was noted that Rs. 63,000/- had been received up to the date of the AGM).

Mr. Rishad Naoroji suggested that fund raising activities should be entrusted to professionals responding to the above suggestions, Mrs. D.S. Variava stated that there was a certain hesitation among prospective donors to assist the Society. It is necessary to instill a sense of confidence in BNHS in the minds of donors and others through building up its image. Constant changes in personnel caused uneasiness in the minds of donors about the stability of the Society.

Ms. Bharucha inquired about the manner in which the Pirojsha Godrej Field work Fund (page 5 of the Statement of accounts) was being utilised. Dr. Pratap R. Saraiya clarified that this item was a corpus and only the interest earned thereon was to be utilised for the Society's activities.

Mr. N.D. Mulla enquired about the nature of expenditure amounting to Rs. 1,66,606 and the claim for reinstatement by staff at Bharatpur (item ii and iii on page 3 of Auditors' report). The Hon. Secretary clarified that the former represented the expenditure on preparing the report on Bharatpur Project; about the latter the Personnel Sub-Committee was looking into the cases filed by the staff in the Labour Court at Bharatpur.

Fr. Leopold J. Soares drew attention to the drop in the income from sale of books. The Hon. Secretary clarified that this was due to publications going out of print that publication have to be handled on a professional basis. Mr. Nitin Jamdar expressed concern on over the deficit on sale of calendars. The Hon. Secretary explained that this was due to printing of an unduly large number of wall calendars which could not be sold.

Mr. C.N. Chandrashekar desired to know details of the sum of Rs. 6,534/- due from Bihar State Government (item h) of Auditors Report. The Hon. Secretary stated that this covered expenditure for attending a conference at the invitation of the Govt. and assured that efforts are continuing to recover the amount from Bihar Government.

Mr. N.D. Mulla inquired as to how the eletricity charges for running the air conditioning unit were met. He drew attention to the fact that the Rules and Regulations of the Society were amended earlier so as to provide for a nominee of the Government of India on the Executive Committee so long as the Government provided a recurring grant for the air-conditioning.

The Honorary Secretary replied that the Society has requested the Ministry of Environment and Forests for an adhoc grant for the amount spent on electricity charges so far. In case, this was not acceded to the Society will reconsider the issue which may include closing down the air-conditioning unit.

Mr. Behramfram desired to know the manner in which the grant received during the year from Asian Wetland Bureau was spent. The Hon. Secretary replied that the annual waterfowl count was not with BNHS now and that the amount had been received to enable Dr. Robert B. Grubh to conduct an Environment Awareness Campaign in January 1992, at Nagercoil (TN).

Mr. Ulhas Rane cautioned that (a) the Society should not depend on scientific projects only for funds and (b) the grants received for the Building Fund was not adequate for maintenance and it was necessary to build up a sinking fund for maintenance of the building.

Mrs. Variava advised that a proposal for the constitution of a Committee which would include Govt. representatives to look after the 'Collections' was being worked out.

Mr. C.N. Chandrashekar expressed concern about the large amount shown as 'Income outstanding' in the Statement of Accounts. Mr Daniel replied that a large part of the amount has been realised subsequently.

Mr. Ulhas Rane mentioned that this year's audit has been considerably delayed. Mr. C.G. Wakankar explained that the delay was mainly due to (a) the Dy. Director (Accounts) leaving the services of the Society, (b) the Auditor auditing the Society's Accounts having gone abroad in between and (c) disturbed conditions in Bombay in December 1992 and January 1993. Mr. Daniel gave an assurance that this year the Society's audit will be completed in time.

The Balance Sheet and Statement of Accounts was there after adopted duly proposed by Mr. Nitin Jamdar and seconded by Mr. K. Patel.

Item IV) Appointment of Auditors for 1992-1993

M/s Habib & Company, Chartered Accountants, Bombay 400 023 be reappointed as the Auditors for the Society for the year 1.4.1992 to 31.3.1993 on a total remuneration of Rs. 2000/- (Rupees two thousand only).

Dr. Shashi Menon proposed and Dr. A.M. Bhagwat seconded. The proposal was passed unanimously.

Item V) Amendments to Rules and Regulations:
Rules regarding absence from Committee meetings

Mr. N.D. Mulla desired that there should be a referendum on this matter. Mr. Bittu Sahgal, and Mr. K.K. Doctor felt that there was no need for the rule. Mr. Varinder Singh proposed that this amendment should be referred back to the Executive Committee for reconsideration which was seconded by Mr. Balsara. When put to vote, 11 voted in favour of Mr. Virinder Singh's proposal and 23 voted against. Thereafter, Mr. Ulhas Rane proposed to amend the Rule as follows:

Amendment proposed by the Committee

Absence from Committee Meetings:

A member absenting himself/herself without assigning reasons from three consecutive meetings of the Committee shall be deemed to have vacated his/her seat on the committee. In such cases, the Committee shall fill the vacancy by co-opting any other eligible member.

Rule regarding EGM

Amendment proposed by Committee

The quorum for an EGM convened either at the initiative of the Committee or upon the requisition of members shall be the same as prescribed under Rule 24 for Annual General Meetings.

Amendment proposed by Mr. Rane

Absence from Committee meetings

Any member absenting himself/herself without sanction of leave of absence from three consecutive meetings of the Committee will be liable to be removed from the Committee. In such cases, the Committee shall fill the vacancy by co-opting any other eligible member.

When this was put to vote, 20 voted in favour of the amendment proposed by Mr Ulhas Rane and 10 voted against. Thus, Mr. Rane's proposal was accepted.

Amendment proposed by Mr. N.D. Mulla

The quorum for an EGM convened either at the initiative of the Committee or upon the requisition of members shall be the same as prescribed for Annual General Meetings. The amendment was unanimously approved.

Item VI) **Any Other Business:**

Amendment to Rules and Regulations:

Rule 17: Some members suggested that the above rule should be amended so as to provide some proof for being a Student. The Rule, therefore was amended as follows:

"A student of any recognised educational institution shall on the production of proof to this effect from the institution attended, be eligible for election as a student member at such concessional subscription as may be determined by the Committee from time to time".

Rule No. 34: Procedure for Election of Committee:

Mr. Daniel read out the proposal submitted by Mr. Bharat Bhushan suggesting amendment to above Rule so as to provide for

a) The names of the proposer and seconder.

b) Biodata of the candidate to be circulated along with the list of names. Dr. B.F. Chhapgar, Mr. Nitin Jamdar and Mr. N.D. Mulla expressed their views on this subject. The meeting unanimously resolved that all amendments of Rules and Regulations of the Society should be circulated in advance with the notice for the AGM. Accordingly, the amendment in question may be brought before the next AGM.

Hornbill

Mr. Daniel read out the letter received from Mr. Sharad Sane about the loss incurred by the Society in the Publication of Hornbill. Mr Daniel clarified that necessary steps are being taken to cover the loss. Mr. Ulhas Rane suggested that the cost of publishing Hornbill cannot be met through subscriptions alone; it should carry advertisements also.

Translation of works/old issues of BNHS Journal:

Mr. C.N. Chandrasekar stated that he had written to the Society offering his services for the translation of BNHS publications into other languages and also the return of issues of Journal not required by him and that no reply has been received.

Prof. Bole advised the Honorary Secretary to sort out the issue with Mr. Chandrasekar.

The meeting ended with a vote of thanks to the Chair.

ERRATA

Vol.91(2)

NUMBER AND SIZE OF GROUPS OF *PRESBYTIS ENTELLUS* IN FOUR DIFFERENT HABITATS IN AND AROUND JAIPUR, RAJASTHAN

Running head, pages 277, 279, 281

For *NUMBER AND SIZE OF GROUPS OF* PRESBYTIS ENTELLU

Read *NUMBER AND SIZE OF GROUPS OF* PRESBYTIS ENTELLUS

Miscellaneous Note No.38

NEW RECORDS OF PLANTS FROM ORISSA
on p.352, author's name

For A.K. BISWAS

Read A.K. BISWAL

THE SOCIETY'S PUBLICATIONS

The Book of Indian Animals, by S.H. Prater, 4th edition (Reprint). 28 plates in colour by Paul Barruel and many other monochrome illustrations. *(Price to members Rs.* 170*)*

The Book of Indian Birds, by Sálim Ali, 11th (revised) edition (Reprint). 74 coloured and many monochrome plates. *(Price to members Rs.* 150*)*

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